MACHINERY

Design—Construction—Operation

Volume 41 | JUNE, 1935 | Number 10

Tube bending is often thought of as a semi-manual operation; but when seamless-steel tubing is to be bent in quantity, as is done for the seat frames in automobiles, tube bending becomes a production operation for which highly developed machinery must be used. The leading article in July MACHINERY will illustrate and describe how this work is done in one of the Chrysler plants. Other articles will feature uses of cold-drawn steel shapes in machine design; the mounting of tapered roller bearings; and precision boring.

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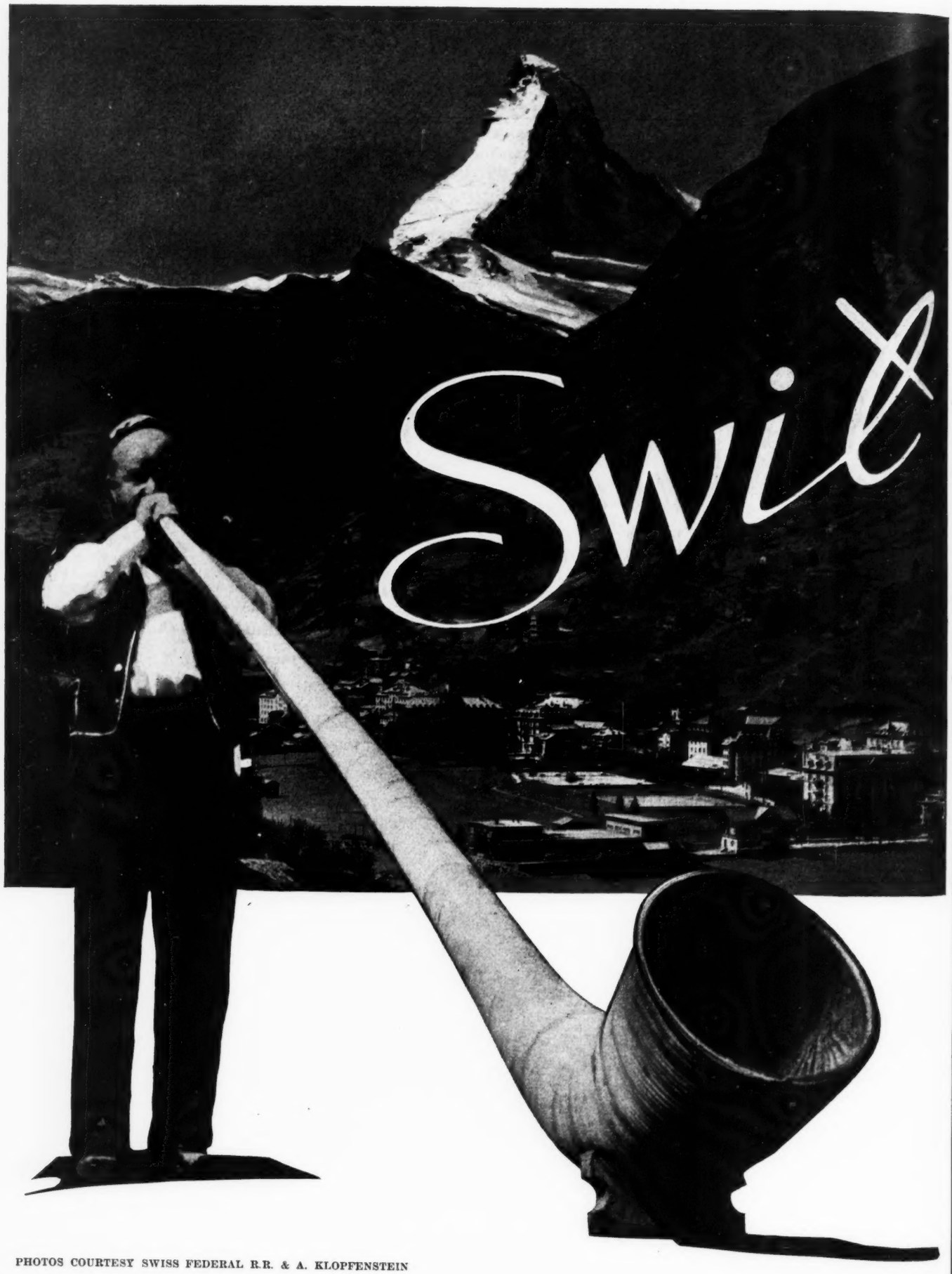

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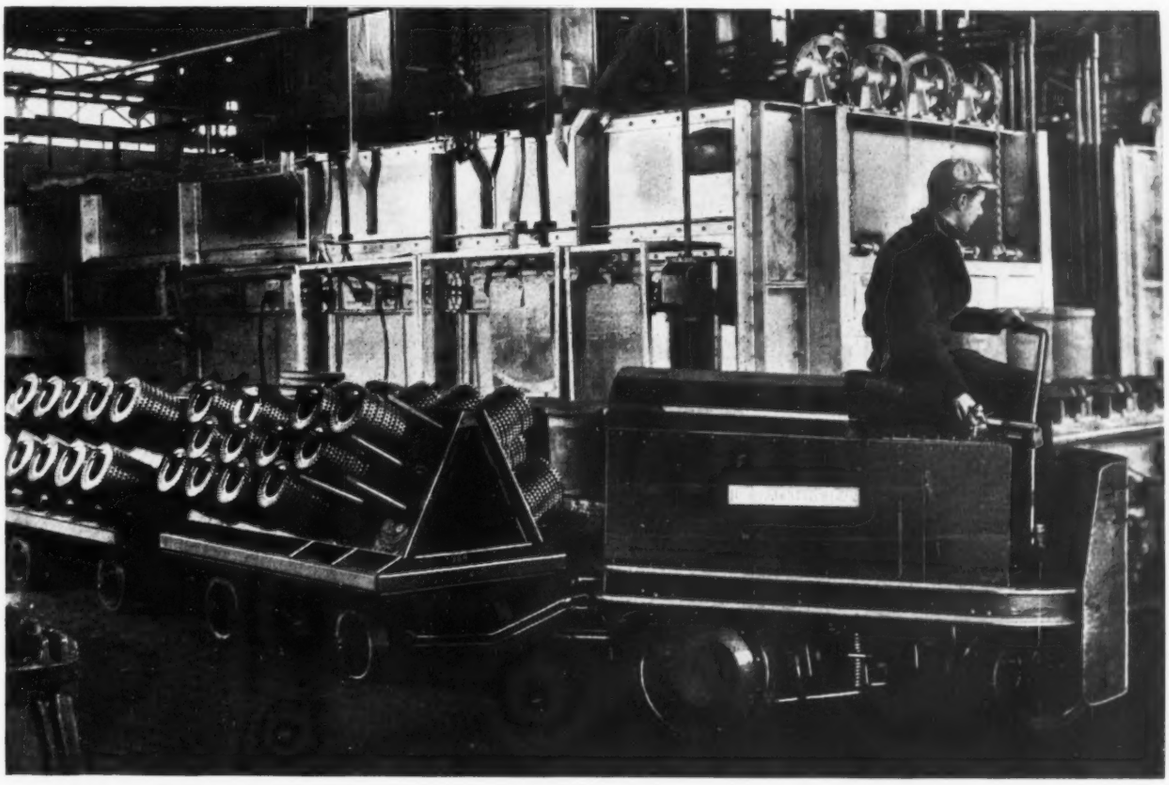


Tractors and Trailers Keep Work Moving in Chevrolet Plants

High Rates of Production are Continuously Maintained on Thousands of Machines through the Efficient System Used for Handling Materials and Work

By CHARLES O. HERB

WORK-HANDLING is a big problem in automotive shops. Thousands of tons of raw materials and unfinished parts must be kept moving from receiving platforms to machines. Parts in process must be moved from machine to machine and between various departments. Finished pieces must be taken to assembly lines or to outgoing points. Scrap must be carried to baling presses or otherwise disposed of. All of this handling of raw materials, work, and scrap must be accomplished expeditiously, in order to avoid congested aisles and to enable production to continue unhampered.

In the Gear and Axle Division of the Chevrolet Motor Co., which is located in Detroit, tractors and

Fig. 1. One of the Receiving Platforms of the Chevrolet Gear and Axle Division — Trailers Provide a Convenient Means of Storing Unfinished Parts Temporarily

trailers are used almost exclusively to take care of the work-handling problem. Conveyors, of course, are employed for assembly operations, and there are several overhead conveyors for carrying parts from machine to machine, and assembled units to shipping platforms, but in the main, the work is handled "on wheels."

The fleet of tractors and trailers employed saves a vast amount of manual labor, keeps production going smoothly, and has practically eliminated accidents attributable to work-handling.

A Large Variety of Work is Handled by Tractors and Trailers

The Chevrolet Gear and Axle Division comprises four adjacent plants: Plant No. 1 manufactures ring gears, stem pinions, torque tubes, and rear-axle assemblies; Plant No. 2 produces stampings of many different types, rear-axle parts, and both front- and rear-axle assemblies for trucks; Plant No. 3 makes wire wheels, produces the front-wheel knee-action parts, and completely assembles the front-wheel units; and Plant No. 4 produces service parts, truck brake-drums, and front-axle assemblies for "Standard" Chevrolet models. This plant also contains die, tool, and maintenance shops for the entire division.

Obviously, the various parts manufactured must be handled time and time again as they proceed from machine to machine and from department to department. In peak times, there are approximately 5000 men in the four plants in each shift. The work for this large number of men is handled by about 45 tractors and from 800 to 1000 trailers. Loads run as high as 7200 pounds per trailer.

Some of the Advantages Gained by the Transportation Arrangement Used

One of the fundamental advantages derived from the use of tractors and trailers for handling work is that a loaded trailer can be readily moved short distances by hand. Therefore, a trailer loaded with incoming work can be left adjacent to a machine and when the work is required, the trailer can be pulled by the operator into the most convenient position. Likewise, trailers that have been filled

Fig. 2. Tractors Deliver Loaded Trailers to Any Point in the Four Plants with Minimum Delay. Not More than Four Trailers are Allowed to be Run in a Train

Fig. 3. Dump Type Trailers Filled with Scrap in the Stamping Department can be Emptied Directly into Baling Presses, Saving Considerable Arduous Labor

with finished pieces of work can be pulled aside by hand to make room for empty trailers. In such cases, it is not necessary to call for the services of a "power unit."

The use of tractors enables loads of different parts to be transported simultaneously through the shop by one power unit and the various trailers can be conveniently disconnected from their train as their destinations are reached. A tractor train can go anywhere in the shop and at speeds that minimize delays in the receiving and dispatching of work.

Trailers provide a convenient means of storing work temporarily until it is required at machines, as will be seen from Fig. 1, which shows a general view of a receiving platform adjacent to one of the plants. Sometimes loaded trailers cannot be drawn close to machines when space is limited, and in such cases, a tractor can be used to push the trailers into place. Fig. 4 shows a tractor being used for pushing trailers on a large motor-truck trailer of a type used for transporting tractor trailers between the four plants of the division. Tractors can also be used advantageously for pulling loads directly into railroad box cars, as will be apparent from Fig. 5.

Types of Tractors and Trailers Used

Both electric storage battery tractors and gasoline-engine tractors are employed, but electric tractors are being given the preference more and more, especially for use inside of buildings. The tractors are generally of the four-wheel type. They are equipped with safety devices to minimize the chance of accidents. For example, tractors of the type shown in the illustrations are so arranged that when the driver rises from his seat, brakes are automatically applied and the controller is disconnected from the electrical circuit. The tractor cannot be started until the driver resumes his sitting position.

Trailers can be readily built to suit the particular work for which they are intended. Some are of all-steel construction, while others are built of steel and wood. The trailers may be of the simple

Fig. 4. Large Motor-truck Trailers are Employed to Take Tractor Trailers, Four at a Time, Back and Forth between the Different Plants of the Division

Fig. 5. Loaded Trailers Can be Readily Pulled into Freight Cars Standing on Railroad Sidings

platform type shown in Fig. 1, which facilitates the handling of long pieces; of the box design illustrated in Fig. 2, which is intended primarily for handling small pieces; or of a special type, like the one shown in the heading illustration.

Trailers equipped with racks, as shown in the heading, are used to carry ring gears from the gear-cutting machines to the heat-treating department for carburizing, hardening, and tempering, and then to the grinding department, noise-testing room, and assembly lines. Racks arranged similarly, but having holes instead of supporting pipes, are provided for carrying stem pinions. Scrap from punch presses is generally loaded into dump type trailers of the construction shown in Fig. 3, for transportation to baling presses.

An efficient application of platform trailers is shown in Fig. 6. At the right is seen a trailer loaded with long steel sheets, from which stock is blanked and drawn by a heavy-duty power press. As the operator removes the sheets of scrap material from the machine, he stacks them on the trailer at the left, which is similar to the one at the right except that pieces of pipe are placed vertically in holes in the trailer platform to keep the scrap from falling off. As a trailer is emptied of its load of stock, it can be pulled into position to receive the scrap.

All trailers are equipped with rubber-tired wheels to save wear and tear on the floors, to provide for noiseless operation, and to reduce jarring of the work. The wheels of the tractors are also rubber-tired. As the tires become worn, they can be easily replaced. Some trailers are of the all-wheel steering design, while others are equipped with casters.

Tractor Operators are Licensed by the Safety Department

Stringent rules have been drawn up by the Safety Department to control tractor operation. No one (not even a foreman) is allowed to drive a tractor unless he possesses a license issued by the director of safety or his assistant. A license is issued only to men who have been thoroughly trained for the job or who have had previous experience. They must first satisfy the Safety Department of their capability. As a further precaution, the safety inspectors in the different plants keep a constant check on the tractor operators to make sure that they observe all rules that have been set up to govern tractor operation.

These rules appear on the back of the license card, and the operator is obliged to carry his card at all times when at work. One of the rules naturally pertains to operating speeds. In areas where many men are at work, and where machines are close together or material is stacked high, tractors must be driven at speeds slow enough so that they can be stopped within 6 feet. There is a two-mile-an-hour limit in passing in or out of doors and in going around blind corners. At other points, the speed depends upon conditions, but the operator is warned that the penalty for careless driving is discharge. Any accident involving injury to persons or damage to property calls for the dismissal of the operator.

The horn must always be sounded when a tractor is entering or leaving a building or rounding blind corners. A tractor must never pass men walking in aisles in the same direction that the tractor is going unless the men are walking very slowly. They can then be passed after the horn has been sounded to obtain a clear passageway. Tractors must never be operated two abreast, and one tractor must not pass another going in the same direction.

Not more than four trailers, loaded or empty, are to be hauled at one time. Passengers must never be allowed on either tractors or trailers. In driving into freight cars, the operator is responsible for seeing that the dock-boards are securely fitted to the car and to the plant platform.

Operators of gasoline-powered tractors are compelled to keep both hands on the steering wheel at all times, except when shifting gears or backing. The engine must always be shut off before the gasoline tank is refilled. Should a gasoline leak develop, no matter how small, the engine must be stopped at once and a report made to the Tractor

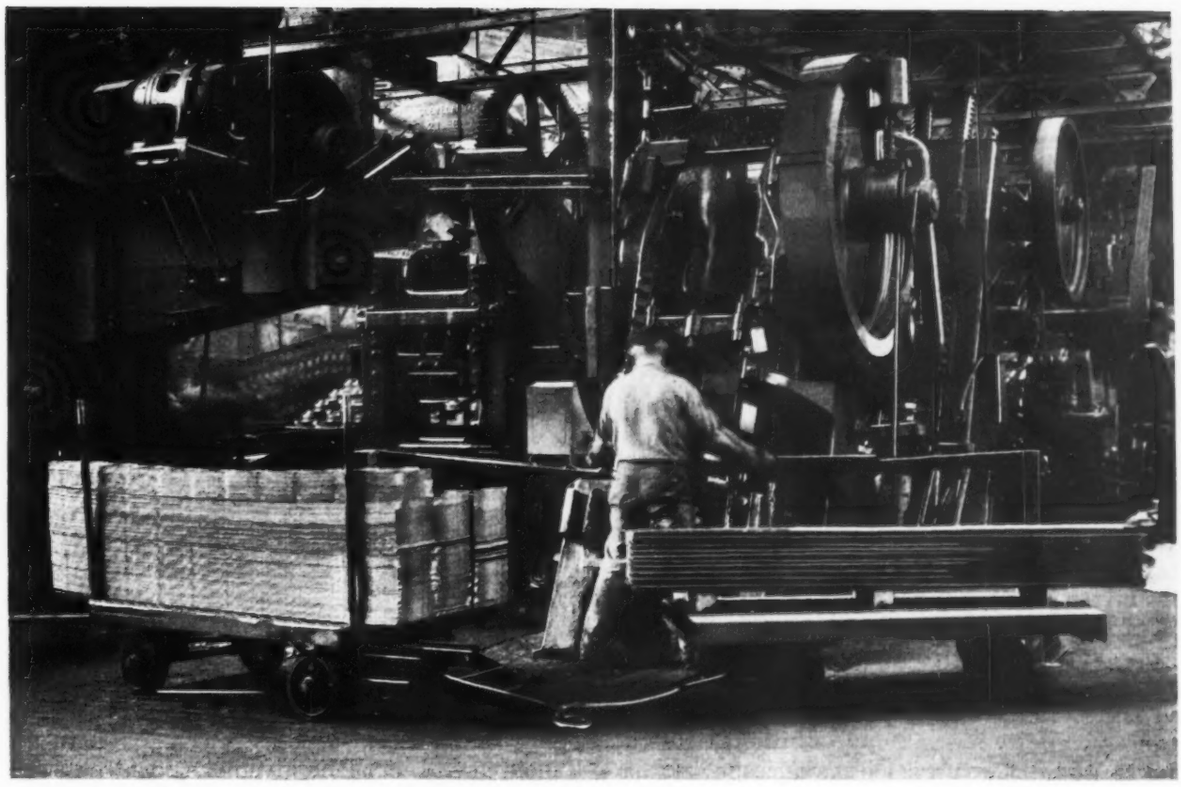


Fig. 6. Trailers Loaded with Unfinished Work, and Empty Trailers for Finished Parts or Scrap, can be Positioned by Hand to Afford Greatest Convenience to Machine Operators

Maintenance Department. Mechanical defects must also be reported immediately. The tractor operator is obliged to inspect the wheels, brakes and steering gear daily, and if any of the mechanisms is defective, he must refuse to drive the tractor until repairs have been made.

In the event that a tractor is involved in an accident, the operator must immediately make a full report to the Safety Department and to the Material Department, so that an investigation can be quickly instituted in order to place the blame where it belongs.

The British Machine Tool Industry

According to a report made by Consul William W. Heard, of Birmingham, England, to the Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., the machine tool industry in Great Britain, particularly in the Birmingham district, enjoyed considerable activity during the first quarter of this year. Deliveries are quoted from two to three months, and the conditions generally reflect a definite recovery in the principal machine tool using industries.

While the main demand continues to come from the automobile industry, there is a more general demand from all other industrial fields than there was some months ago. There is a general tendency to replace obsolete machinery, and there is also a scarcity of second-hand equipment. These two factors have stimulated the machine tool business to a marked degree. The export demand has also shown an appreciable increase.

Within the last two months, there has also been a marked increase in orders from the Soviet Union. The exports of machine tools to Russia during January and February of this year were valued at close to $500,000.

It is also of interest to note that in spite of the fact that the present British tariff mitigates against the importation of American machine tools, the latest official trade statistics show an increase in the volume of imports of American machine tools, as compared with previous years. Still this trade is almost wholly confined to specialized equipment not produced in Great Britain.

Making Molds for Plastic Materials by the Electroplating Process

Bronze Shells Made by Depositing Metal on a Form or Pattern are Backed up with Cast Aluminum and Used for Molding Soft Rubber and Synthetic Plastics

By HERBERT CHASE

THE cavities of molds for forming rubber and other plastic materials are usually required to be machined or hobbed from solid stock. The material may be a bronze alloy in the case of rubber and some other plastics, but in the case of phenolic and urea thermosetting materials, it is generally steel, which is subsequently hardened or plated with chromium to afford wear resistance. When the molded piece is to have an irregular surface which is not easily machined, and especially when considerable engraving is required, the cost of the mold mounts rapidly. In some instances, especially when several cavities are required, hobbing can be done, but hobbing is a rather slow and expensive process and the hob itself is often expensive and may be broken in use.

An alternative method of making molds having bronze cavities has recently been developed by Process Molds, Inc., Fort Wayne, Ind. The new method is in some respects the reverse of the conventional method, in that it starts either with the article to be molded or with a metal pattern of the article. In either case, the surface of the article or pattern must be such, or be treated in such a way, that it can be plated, which, of course, involves submersion in a plating solution.

In this process, plating is done with bronze, and after a considerable thickness of the metal has been built up by the plating, the plated shell is stripped from the pattern or form and is, of course, an exact matrix of the article to be molded. This matrix, being rather thin, is not strong enough to act as a mold cavity, but it is given the required stiffness by casting aluminum around it.

If the mold thus formed is still not strong enough to withstand the heavy pressures often required in molding plastics, it may be set into a steel chase made up to fit it closely. If a multiple-cavity mold is required, the design can be such that each of the cavities made up in the manner indicated can be set into a common chase.

The great advantage of this process is that it yields a faithful replica of the pattern or piece itself without the need for machining the cavity or cavities required. In particular, fine detail, such as the weave of a fabric, or even a "watered" design in silk or the fine detail of a hand-engraved object, is reproduced exactly and with greater fidelity than even an expert in engraving can achieve. If abrasion resistance is required, the bronze surface can undoubtedly be plated with chromium, and should then withstand prolonged use.

The accompanying illustrations show some of the molds produced by the method described. It is apparent that most of these molds would be quite expensive if they had to be machined or hobbed from solid stock. Up to the present, most of the molds produced by the new method have been for molding soft

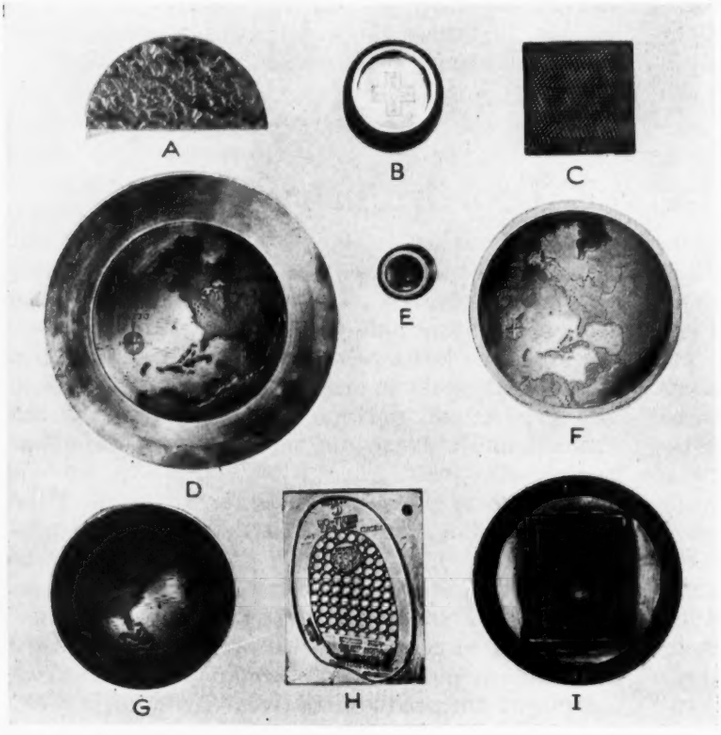
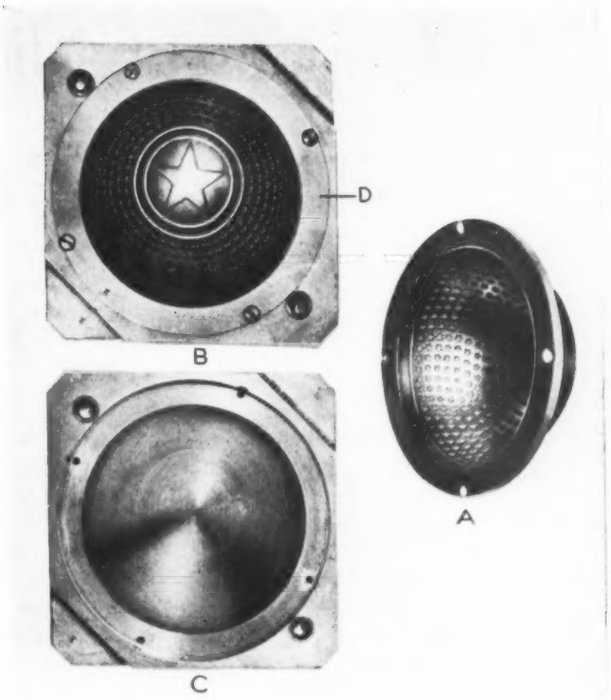


Fig. 1. Group of Molds for Various Products Made by the Plating Method

Fig. 2. Two Halves of a Steel Chase and Mold Insert Used in Molding a Rubber Ball



rubber or for forming pyroxylin sheet by the "blowing" process, in which the sheet material is forced into the cavities under steam pressure. Several molds for producing phenolic plastic moldings have been made, however, with success. In these cases, the mold cavity is inserted in a chase which supports it under the heavy pressures applied.

Although the entire mold cavity can be made up in the manner indicated, it is not necessary that this procedure be followed. In some instances, only an insert forming a portion of the cavity is made in this way and the remainder of the mold is cut out of solid stock. Molds made by this process are suitable for production purposes, but the same process can be used to advantage in making experimental molds. If it then develops that the part molded has to be altered in some respect, the pattern used in making the mold can be changed accordingly and a new mold constructed at comparatively low cost, as compared to machining a new cavity in a mold made from solid stock.

In Fig. 1, an insert for making a "watered silk" pattern in a mold for a Bakelite part is shown at *A*. Parts of molds for making rubber shoe soles are shown at *C* and *H*. At *F* is shown an insert for producing half a globe of a phenolic material. The other half of a globe mold with the insert in a steel chase is shown at *D*, while at *G* is shown a phenolic piece made in the mold *F*. Molds for bottle caps are shown at *B* and *E*. At *I* is shown a mold for making part of a vanity case from a phenolic compound. The interchangeable insert *A*, Fig. 2, is used for molding a rubber ball. The two halves of the chase are shown at *B* and *C*. The engraving of a hob for producing a mold of this type in the ordinary way would be quite expensive.

Increasing Use of Machinery and Industrial Employment Go Together

According to a study made by the National Industrial Conference Board for the National Machine Tool Builders' Association, the percentage of the population gainfully employed in the United States increased from 32.4 per cent to 39.8 per cent during the sixty years from 1870 to 1930. Since this period is also the one that marked the most rapid technological improvements in industry, the introduction of labor-saving devices on a large scale, and enormous mechanization of industry, these figures are especially significant.

Furthermore, at the beginning of this period—in 1870—more than one-half of the total labor of the country was engaged in agricultural pursuits, while in 1930, the farmers represented only a little more than one-fifth of all workers, indicating that industry has absorbed a constantly increasing share of workers, in spite of the fact that industry has also, during the same period, developed labor-saving machinery to a hitherto undreamed of degree.

In spite of all the misinformation that has been published about machine developments being responsible for unemployment, the fact remains that at the end of the great development period in 1930, a larger proportion of the total population was employed in producing goods and rendering industrial services than in the earlier periods when there was less machinery and more hand labor.

* * *

According to *Tool Tips*, published by the Ex-Cell-O Aircraft & Tool Corporation, a solution of 1 1/2 ounces of Lysol to 1 gallon of oil has been found to prevent infections in small cuts and scratches. This proportion of Lysol is equivalent to approximately 1.2 per cent. The original suggestion for this application of Lysol is credited to the Metropolitan Sewing Machine Corporation, of Nyack, N. Y.

Applications of Nickel Alloy Steels and Cast Irons in the Tool and Die Field

By J. W. SANDS
Development and Research Department
The International Nickel Co., Inc., New York

THE value of nickel steels and irons for machine tool parts, such as gears, cams, pulleys, spindles, beds, etc., is too well known to require comment, but their application to tools and dies is perhaps not so well known. It is the purpose of this article to review briefly some applications of this type, in which the use of nickel alloy steels and irons has been found advantageous from the standpoint of both performance and length of life.

A list of these applications is given in the Data Sheets accompanying this number of MACHINERY. The compositions of the various materials are also indicated. It will be noted that these fall into three general classifications—casehardening steels; medium- and high-carbon oil-hardening steels; and cast iron.

The casehardening steels are suitable for applications requiring high surface hardness combined with toughness, such as arbors, broaches, and collets. They combine hard, tough, wear resistant, non-spalling surfaces with cores strong enough to afford excellent support to the case and tough enough to resist accidental or routine shocks and overloads. Their resistance to grain growth permits of simple heat-treatments, and their low critical temperatures and ability to harden in oil minimize scaling, warping, and distortion.

Arbors and collets are sometimes made of a direct-hardening nickel-chromium-molybdenum steel. While surface hardness as great as that of a casehardened steel cannot be obtained, this steel can be hardened considerably without becoming brittle. This practice eliminates the carburizing operation, reduces heat-treatment costs, and simplifies handling.

The desirable combinations of strength, fatigue resistance, ductility, toughness, hardenability, ease of heat-treatment, and non-distortion inherent in the various direct-hardening alloy steels make them suitable also for many other tool applications, such as boring-bars, calking tools, chisels, blanking dies, cold-heading dies, forming dies, ring and thread gages, hammer heads, hobs, punches, hydraulic rams, screwdrivers, wrenches, etc.

One of the most important applications of nickel-chromium-molybdenum steel is in drop-hammer die-blocks, the majority of which are now made of this steel. The factors responsible for this choice include minimum distortion, high hardenability, great toughness, resistance to heat checking, machineability at high hardness, and greater production per block.

Nickel-chromium cast iron has won merited recognition as a die material because, in many cases, it will give service approaching that of high-grade die steel at a fraction of the cost. Such dies are extensively used in the automotive and sheet metal industries because they are strong and hard, yet machineable, possess a fine grain and assume a high polish, and eliminate galling and streaking of the formed metal. Owing to their economy, nickel iron dies are also satisfactory for pressing and striking applications when high finish and sharpness of outline are not essential, as in the manufacture of novelty coins and tokens.

Being resistant to heat and mild shock, they are successfully employed for a number of drop-forging and hot-processing applications. They compare well with steel dies for forming shovel blades and shanks, plow points, cultivator teeth and other parts of farm implements, as well as for light and medium brass, bronze, and nickel silver forgings. In more severe service, when only a limited number of pieces are required, their use is justified by economies in material and die-sinking costs. Impressions can be cast nearly to shape or formed by squeezing a sample piece between two heated blocks.

* * *

General Electric Employes Receive Awards

Forty-four awards have been made by the General Electric Co. to forty-two men and two women in the company's employ for their contributions to the progress and prestige of the company and to the advance of the electrical field. These awards are made under the rules of the Charles A. Coffin Foundation, established by the directors of the company as a tribute to the late Charles A. Coffin, founder and first president of the company. Of the employes honored this year, fifteen are factory men, twenty are engineers, five are commercial employes, three are administrative and clerical employes, and one is a construction foreman.

Adjustable Die-Casting Dies for Parts of Different Dimensions

Two Sets of Dies Adapted by the Use of Inserts for Producing Castings of Different Lengths and Widths

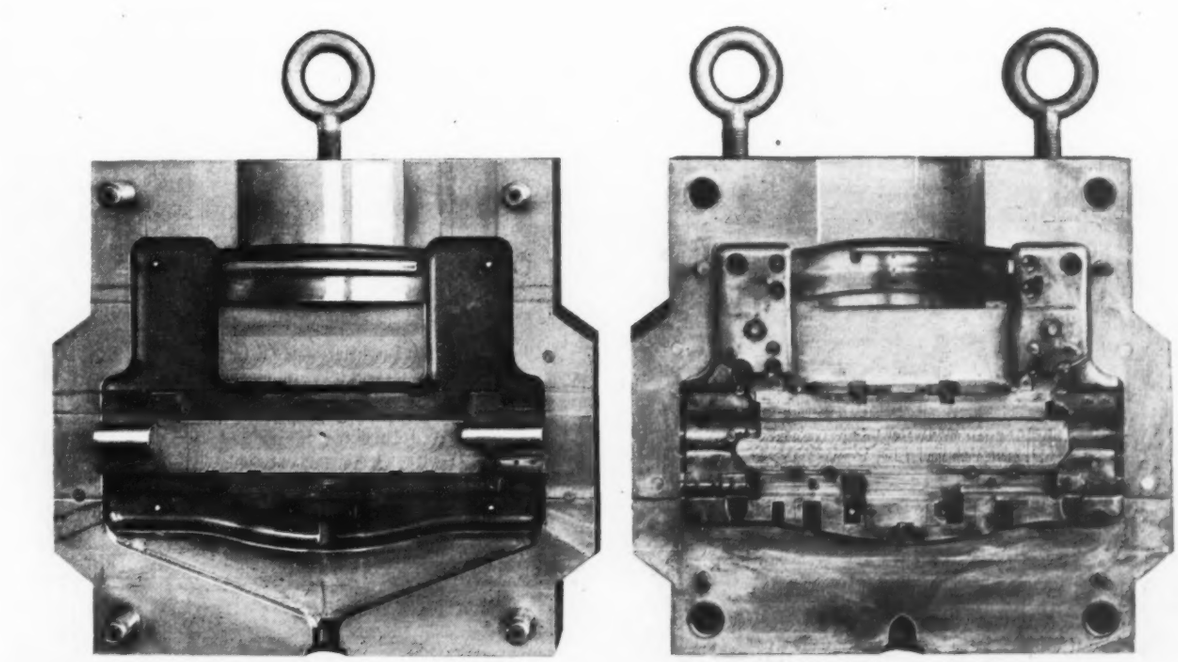
By CHARLES O. HERB

IN the iron foundry, it is common practice to use one set of patterns and core-boxes for producing large castings that are identical except for length or width. The mold is merely cut off or extended to suit the dimensions of the different castings.

This age-old principle of the foundry has been applied by the Madison-Kipp Corporation, Madison, Wis., in designing modern die-casting dies. Typewriter top plates of the type illustrated in Fig. 2 are produced in three different lengths by means of the dies shown in Fig. 1. The lengths of the top plates are approximately 13, 16 1/2, and 20 1/2 inches. Inserts are provided at both ends of the dies, which are interchanged in order to produce castings of these three lengths. In Fig. 3, the dot-and-dash lines *X* and *Y* show the ends of the inserts used on one side of the movable die for producing castings of medium and greatest lengths, respectively, while the solid lines show the end of the insert that produces the shortest top plate.

It will be apparent that, in Fig. 1, the dies are arranged for casting top plates of the shortest

Fig. 1. Dies Arranged for Producing Typewriter Top Plates, Such as Shown in Fig. 2, in Three Different Lengths by Interchanging Inserts



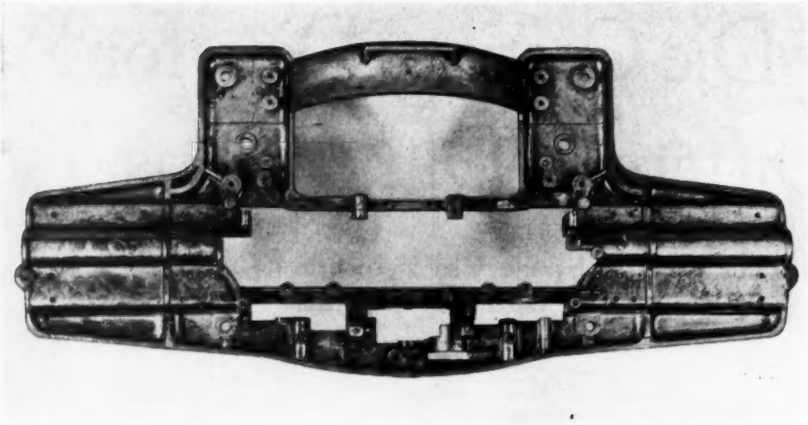


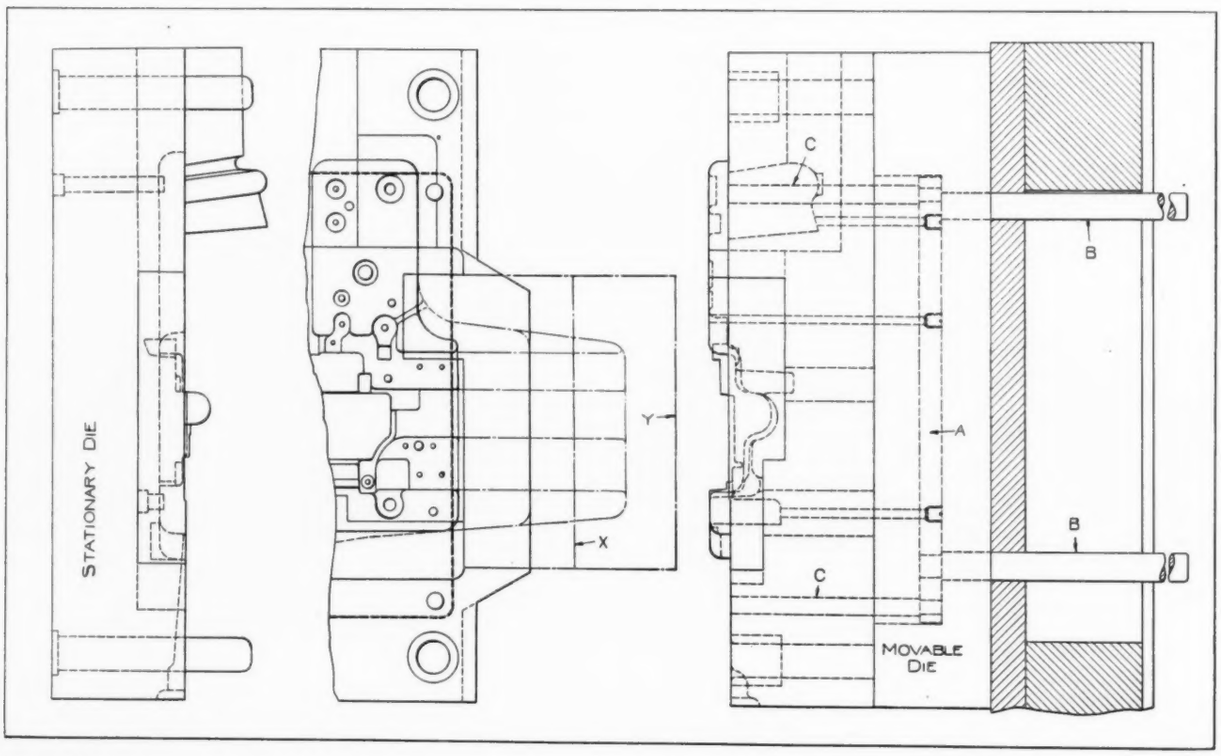
Fig. 2. Typewriter Top Plate, which Must be Produced within Close Tolerances in Spite of the Long Thin Sections and the Large Openings

length, whereas the top plate in Fig. 2 is the largest of the three produced. In the longest top plate, there are fifty-one holes, ranging from 1/16 to 5/16 inch in diameter. The tolerance for the center-to-center distance between the holes at the extreme ends of the casting is plus or minus 0.002 inch. Holes of shorter center-to-center distances are held within plus or minus 0.001 inch. Practically all of the cores for producing the small holes are embodied in the movable die, which is shown at the right in Fig. 1.

Fig. 3. Drawings that Indicate the Irregular Parting Line Required for Producing the Typewriter Top Plate Shown in Fig. 2

It is generally a comparatively easy matter to plan the paths of the parting lines, in designing the average run of die-casting dies, but considerable difficulty was experienced in locating the parting lines for the dies used in making the typewriter top plates. These castings are of comparatively thin section for their entire length, and in spite of the large cored openings, the parts must be held straight within close limits. Before the parting lines could be decided upon, it was found necessary to make a clay model of a typewriter top plate from a pattern that had been submitted. The paths of the parting lines may be followed by studying the dies in Figs. 1 and 3.

Thirteen ejecting pins arranged on plate *A*, Fig. 3, force the casting from the movable die at the end of the operation. Plate *A* is actuated by four pins *B* which strike stops during the opening



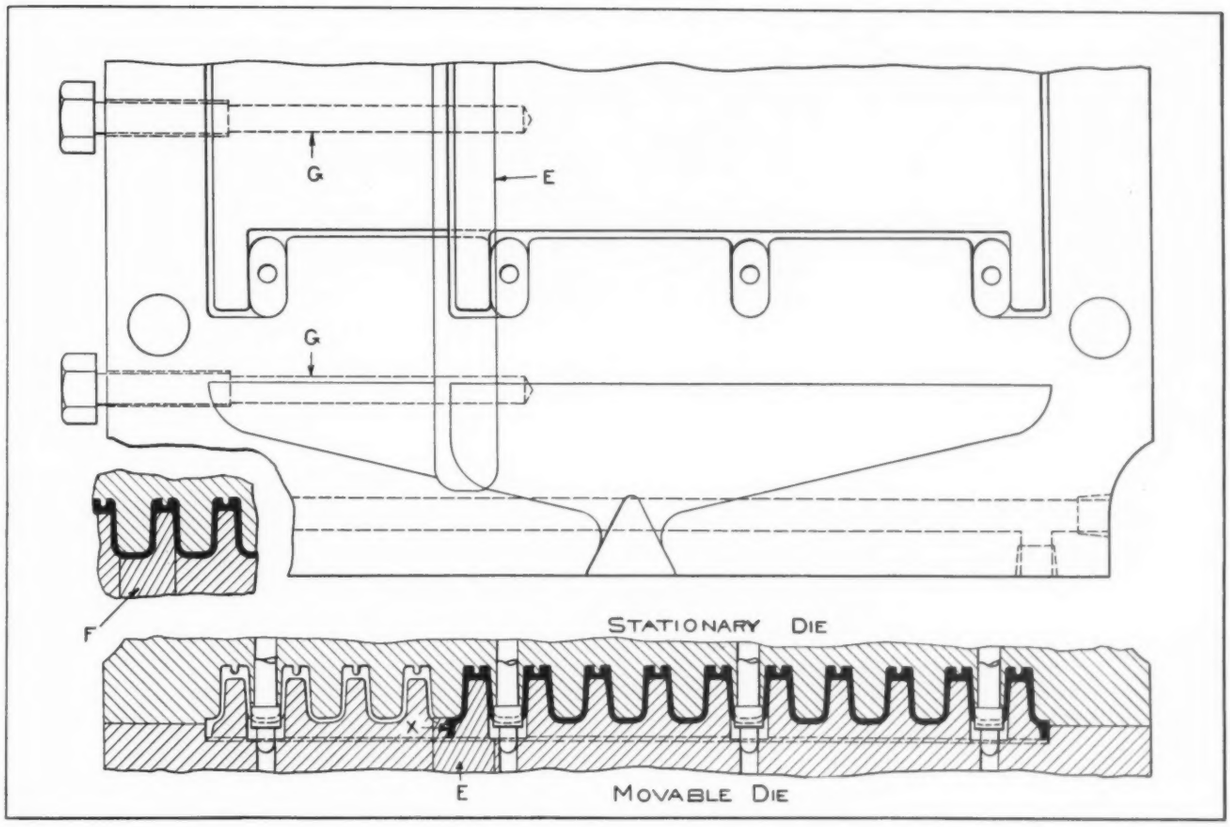


Fig. 4. Construction Drawing of the Dies that Produce Elevator Step Plates of Two Different Widths, Such as Shown in Fig. 5

movement of the die. The ejecting-pin plate is returned to the casting position when pins *C* come in contact with the face of the stationary die as the dies are closed. The typewriter top plates are cast from zinc, which has a melting point of about 810 degrees F. An average production of 45 castings an hour is obtained.

Elevator step plates of two different widths are shown at *A* and *B*, Fig. 5, and the under side of the narrow plate is shown at *C*. These two plates are also produced in one set of dies through the use of inserts which can be interchanged in the movable die member shown at the right in Fig. 6. When the narrow plate is to be produced, an insert of the design illustrated at *E*, Fig. 4, is used. This insert has a shoulder *X*, which shuts off the die cavity and forms one end of the die-casting. When the wide step plate is to be cast, insert *E* is replaced by another having a cross-section such as illustrated at *F*. This insert continues the die cavity and allows the metal to be forced to the extreme left-hand side of the cavity. The inserts can be

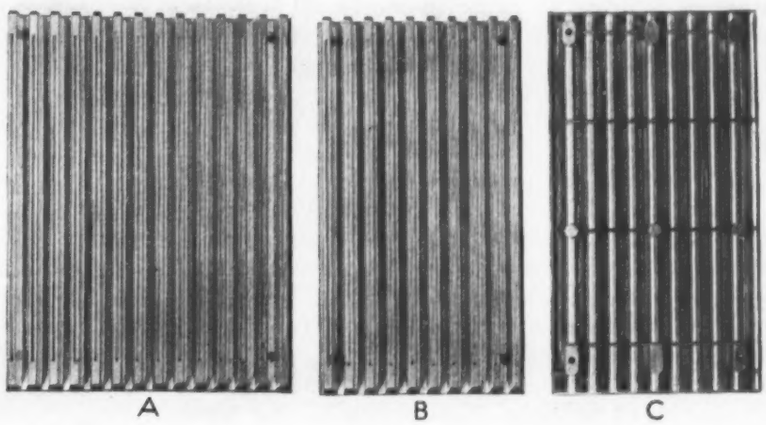


Fig. 5. Two Different Widths of Elevator Step Plates which are Cast in the Dies Shown in Figs. 4 and 6

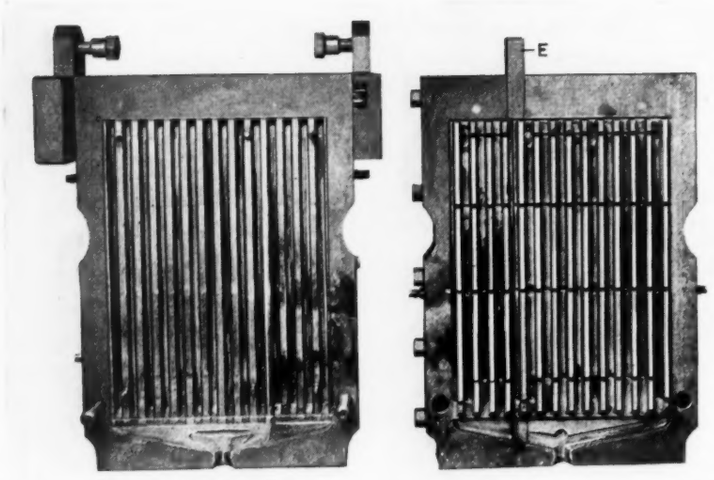


Fig. 6. Dies Designed for Casting Elevator Step Plates of Two Different Widths by Merely Changing the Insert Indicated at E

conveniently interchanged by merely removing five screws *G*.

A large number of ejecting pins are required on the movable die because of the many long ridges of the casting, there being a total of sixty-seven ejecting pins all together. These elevator step plates are also cast from zinc. The rate of production averages 50 plates an hour.

Cleveland Meeting of National Metal Trades Association

The thirty-seventh annual meeting of the National Metal Trades Association, held in Cleveland on May 15 and 16, was characterized by the number of papers presented in which the present industrial conditions and governmental activities were thoroughly analyzed. It would be difficult, among the many papers presented, to pick any one that did not contain both important information and timely suggestions.

Gilbert H. Montague, attorney of New York City, read a paper entitled "Appraisal of the NRA," and W. B. Bell, president of the American Cyanamid Co., New York, read a paper on the subject "How to Retard Recovery," both papers covering important phases of the industrial problem. Malcolm Muir, president of the McGraw-Hill Publishing Co., Inc., New York, read a paper on "The Threat of Political Banking to the Durable Goods Industry," and James Emery, general counsel of the National Association of Manufacturers, Washington, D. C., presented equally definite ideas in an address entitled "Facts and Fairies."

Louis Ruthenburg, president of Servel, Inc., Evansville, Ind., gave an address on "Practical Treatment of Industrial Relations Problems," while Judge R. V. Fletcher, vice-president and general counsel of the Association of American Railroads, Washington, D. C., brought out some important railroad facts in his address "Transportation and Business Recovery."

The economical side of today's perplexing problems was dealt with in "Economics of the New Deal," by Professor O. G. Saxon of Yale University, New Haven, and in "Prosperity and Social Security," by Professor Edwin S. Todd, Miami University, Oxford, Ohio.

At the annual dinner, Hon. Dr. Charles A. Eaton, member of the House of Representatives since 1925, spoke on "Where Do We Go from Here?" Dr. Eaton's broad experience as editor, author, head of the National Service Section of the Emergency Fleet Corporation during the World War, and director of industrial relations for the National Lamp Works of the General Electric Co., has given him exceptional opportunities to study the complex industrial problems of today and their relation to national affairs. Malcolm W. Bingay, editorial director of the Detroit Free Press, who, through many years of experience in the field of journalism has acquired a thorough understanding of political and business institutions, spoke on "America at the Crossroads."

The officers of the Association were re-elected, Alexander Sellers of William Sellers & Co., Inc., Philadelphia, continuing as president.

* * *

As an indication of how new industries help to increase employment may be mentioned the fact that, according to estimates, one in every six of all people in the wholesale, retail, and service trades are engaged in the distribution and servicing of gasoline and automotive products.

Applications of Ball Bearings to Live Centers

Centers Equipped with Ball Bearings Have Been Developed to Meet the Requirements for Higher Speeds and Heavier Loads

By H. W. HOLDSWORTH
The New Departure Mfg. Co.
Bristol, Conn.

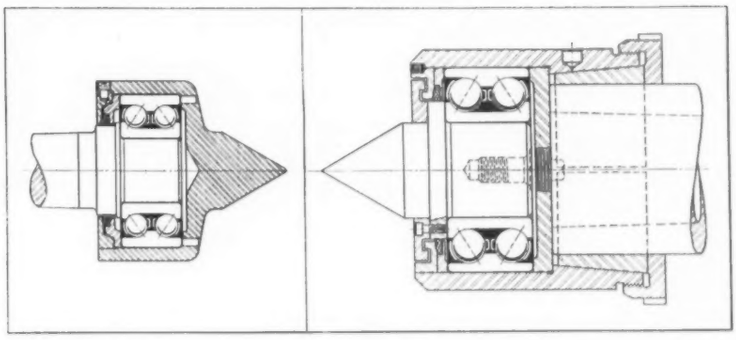


Fig. 1. Ball-bearing Live Center with Point Formed as Part of Bearing Housing

Fig. 2. Ball-bearing Live Center Fitted Directly to End of Tailstock Quill in Order to Reduce Overhang

THE remarkable improvements in speed and accuracy that characterize machines of recent design have been made possible by the development of parts which have previously received comparatively little consideration. It has been evident for some time that work located on centers for machining at the greatly increased speeds now employed must be supported with greater rigidity and in such a way that a higher degree of accuracy would be assured, not only initially but over long periods of operation. Obviously, this necessitated the use of some form of live center which, being in positive contact and revolving with the work, would eliminate the scoring and resultant variable support of the dead center when utilized for high speeds or heavy loads.

When work along this line first became of general interest, it was known that certain forms of ball bearings, particularly the double-row types, could be so preloaded and mounted as to fulfill the requirements of rigidity and accuracy without any serious effects from relatively high-speed operation. In designing this type of live center, it was necessary to adapt it to existing equipment. For this reason, the bearing was fitted on the end of a standard taper shank, a fairly heavy press being used to avoid the need for a lock-nut and thereby reduce the overhang of the point as much as possible.

Using bearings made to precision tolerances and internally preloaded, live centers of this type (see Fig. 1), with the center point formed as an integral part of the bearing housing, proved extremely successful up to a condition where the load was heavy

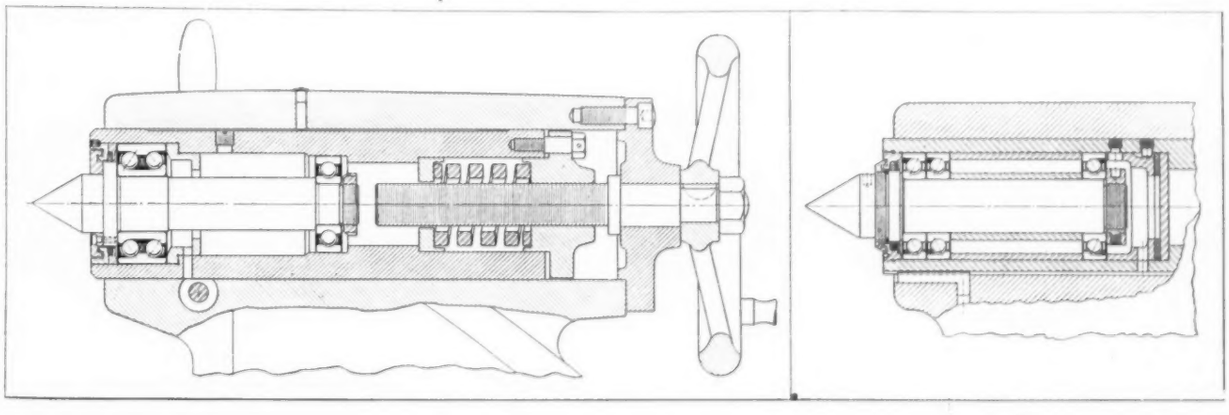


Fig. 3. Tailstock and Ball-bearing Center Designed to Permit Expansion of Work when Long Pieces are Subject to a Considerable Change in Temperature during the Course of the Machining Operation

Fig. 4. Type of Built-in Live Center Designed to Operate at High Speeds and Withstand Heavy Thrust Loads Due to Work Expansion

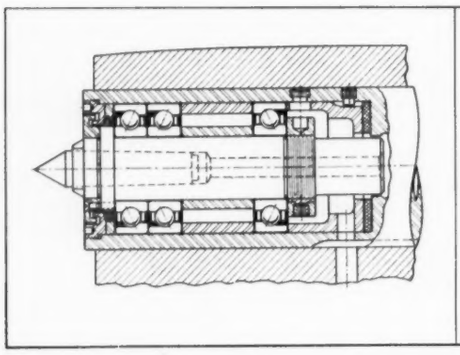


Fig. 5. Similar Design to that Shown in Fig. 4, Except that Center Points are Interchangeable

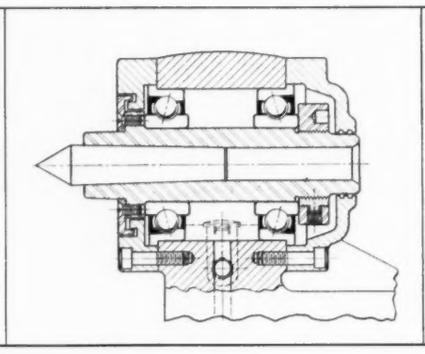


Fig. 6. Design of Live Center Especially Suitable for Light, High-speed Work

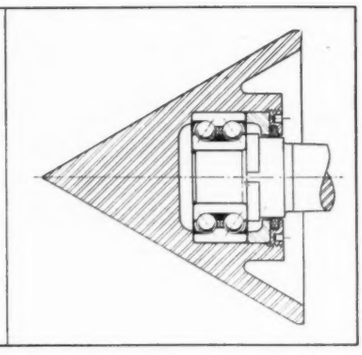


Fig. 7. Ball-bearing Center for Handling a Wide Range of Pipe or Tubing

enough to cause deflection of the taper shank. One of the outstanding advantages of this center was the fact that the point could be rotated and ground on the bearing after assembly.

Later, with the object of reducing the overhang of the center point and eliminating possible deflection of the taper shank, another design was produced which could be fitted directly on the end of the tailstock quill. This type, shown in Fig. 2, required no modification of the quill. Being fitted to a relatively large diameter by means of a tapered split ring, with the bearing located by the end of the quill, it gave adequate rigidity for comparatively heavy work. Although in this design the center point was carried in the inner ring of the bearing, provision was made for driving the point for grinding after assembly of the unit to assure perfectly true running.

With the advantages of properly designed ball-bearing live centers well established by results in service, machine tools in the modern trend of streamlining are now being constructed with the tailstock centers mounted on ball bearings built in as an integral part of the designs. One of the problems encountered in this trend has been that of changes in length of work due to expansion.

For lathes, grinders, and other machine tools intended to rotate work of short or medium length, live center designs in which the ball bearings are mounted without provision for work expansion are satisfactory. This is because the bearings can be preloaded to only a very small portion of their thrust capacity, it having been demonstrated that a relatively small preload provides ample rigidity for all cutting loads when the standard point is used.

In such cases, the moderate changes in work length caused by the maximum operating temperatures merely have the effect of increasing the bearing load, but not to an extent that is materially detrimental to either the life or the accuracy of the bearing. The effect of such limited increase in length is to further compress the balls and races axially, but at the same time, the tendency is to increase the rigidity and the resistance to radial deflection.

In a great many instances, however, machine tools must swing work of such length that the difference in temperature from cold to maximum heat would result in an expansive load so great that no bearing or tailstock of conventional construction could withstand it. A design that has successfully surmounted this difficulty, however, is illustrated in Fig. 3.

In this design, the tailstock quill is allowed a certain axial movement when the thrust, due to work expansion, approaches the thrust capacity of the bearing at the maximum operating speed. That

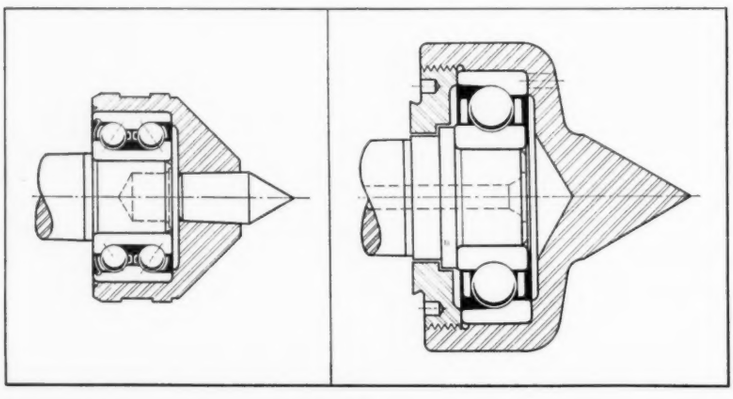


Fig. 8. (Left) Ball-bearing Center Developed for Small Low-priced Types of Lathes

Fig. 9. (Right) Small Live Center used for Metal Spinning at Speeds up to 40,000 Revolutions per Minute

is, a load great enough to compress the spring the limited distance permitted very nearly equals the thrust capacity of the bearing. Rigidity of centering is thus maintained or even increased, and overloading of the bearing is prevented, while, at the same time, the necessity for backing off the center manually is avoided.

Recently designed lathes, in many instances, handle work that is long enough to involve the problem of expansion, and operate successfully at very much higher speeds than would have been considered practicable a comparatively short time ago. A built-in live center used in such a lathe is shown in Fig. 4. The two single-row angular contact bearings mounted tandem at the front end have their faces matched within sufficiently close limits to divide the thrust well between the two.

Centers using more than two bearings applied in this manner have proved successful, but two, especially when made to precision tolerances, provide exceptionally high thrust capacity and are adequate for most work. The rear bearing, mounted opposed to the front pair, acts as a preloading member, since the inner ring is made to extend beyond the outer ring on one side, and when clamped flush against the spacers by the lock-nut, the desired initial axial load is automatically obtained.

An interesting feature of this center is the washer fitted between the quill and the steel spacer which is in contact with the rear bearing outer ring. Being of a compact fibrous nature, this washer is compressible under very heavy thrust loads, such as those due to work expansion, and automatically relieves the front bearings of any danger of being overloaded. The advantage of such a design is that it calls for no greater accuracy in finishing and assembling than any well equipped shop can undertake, and once set up, requires no particular skill in handling by the operator.

The design shown in Fig. 5 is similar to the one just described, except that provision has been made for a knock-out for changing center points. In both cases, oil is used for lubricating, the quill simply being run out of the tailstock far enough to expose a screw, the removal of which permits oil to be introduced into the bearing chamber. Too high a level for high-speed work is prevented by an overflow behind the rear bearing.

So successful have ball-bearing live centers proved, that designs covering a wide variety of machines have been put in use. One developed for lighter, higher speed work than those previously illustrated is shown in Fig. 6. This employs ball bearings of the precision type, made with locating flanges on the outer rings, so that a simple, rigid, and very accurate housing can be used, bored straight through, without inside locating shoulders. These bearings are designed to give not only relatively high thrust capacity, but extremely high radial rigidity with only a very moderate preload. Mounted without spacers, the bearings are initially loaded by a lock-nut which is covered by the rear closure member to prevent maladjustment or tampering by inexperienced operators.

Ball-bearing live centers of the type shown in Fig. 7 are used in machines handling pipe or tubing, and are so designed that a considerable range of diameters can be accommodated without change of center or sacrifice in rigidity of centering.

Another design made to fill the need that has arisen for small inexpensive types of lathes is shown in Fig. 8, in which a small angular-contact preloaded double-row bearing, shielded on one side to keep out dirt, is mounted in a center, the point of which can be changed for light metal-working, as well as for wood turning. The rotating housing is spun over the bearing, in order to avoid the need of threading for a retaining nut, thereby keeping the cost down.

When speeds are far above the ordinary, the use of some form of very accurate, rotating center becomes an absolute necessity. Although the loads are relatively light in such instances, the bearings must have ample thrust capacity to withstand pressures high enough to prevent slippage at the center point. The small live center shown in Fig. 9, which is employed for metal spinning at speeds up to 40,000 revolutions per minute, utilizes a bearing, the internal characteristics of which are such as to assure not only an adequate thrust capacity, but also very accurate radial support under the high speeds. This center requires lubrication with oil, which can be replenished through the hole in the center of the taper shank.

* * *

American Welding Society Issues New Welding Codes

During the last few months, the American Welding Society has prepared and issued a number of important codes relating to the use of welding. These codes are obtainable at a nominal price from the American Welding Society, 33 W. 39th St., New York City. There are seven codes in all, covering the following subjects: Fusion Welding and Gas Cutting in Building Construction—Part A, Structural Steel; Bulletin on Symbols; Marine Code for Welding and Gas Cutting—Part D, Rules for the Fusion Welding of Hulls and Hull Parts; Fusion Welding of Gravity Tanks, Tank Risers and Towers; Welding or Cutting Certain Types of Containers which have Held Combustibles; Fusion Welding and Flame Cutting in Machinery Construction; and Resistance Welding of Structural Steel in Building Construction.

* * *

According to the International Nickel Co., the use of a nickel-steel boiler shell in the first streamline, high-powered, steam locomotive built in America made possible a reduction in weight of 3800 pounds.

Engineering News Flashes

The World Over

Six Million Spot-Welds Without a Single Fault

The value of Thyratron control on spot- and seam-welding machines used for seam-welding evaporator units for refrigerators at the General Electric Schenectady plant is evidenced by the fact that more than 6,000,000 spot-welds and 1,500,000 inches of seam welding have been made on these evaporator units without a single rejection because of faulty welds.

The evaporator unit is made of stainless steel, and requires 310 spot-welds and 75 inches of seam welding. The spot-welding is performed at the rate of 150 welds per minute, and the seam welding at the rate of 72 inches per minute. It is expected that these speeds will be increased—the seam welding to approximately 100 inches per minute and the spot-welding by a similar rate of increase.

Crane Built in Record Time

Recently the Harnischfeger shops in Milwaukee built a three-motor overhead crane of 15-ton capacity, having a span of 100 feet, in a period of sixteen working days. This is believed to be the shortest time in which a crane of this size has ever been completed. It was built for the Inland Steel Co. of Indiana Harbor, Ind., from all-steel construction, with cast-steel trolley frames. The total weight was 168,000 pounds.

Streamline Trains Speed up European Service

On May 15, a new streamline train service was put into operation between Berlin and Cologne in Germany. This distance—359 miles—is covered in five hours and seven minutes, or at the rate of approximately 71 miles an hour, including six intermediate stops.

Oil Engines Gain in Ship Propulsion

In Lloyd's Register of Shipping for 1924-1925, it is shown that out of a total world's tonnage of 61,500,000, ships of a tonnage of 50,740,000 were propelled by steam reciprocating engines; 8,800,000 by either turbines or turbo-electric drive; and slightly less than 2,000,000 tons by oil engines. On June 30, 1934, out of the total tonnage of 64,350,000 the ships fitted with steam reciprocating engines represented only 44,700,000 tons, and those with turbines, 9,000,000 tons, while the tonnage of the ships equipped with oil engines had risen to 10,600,000. There are now 4940 ocean-going ships that are oil-engine driven.

New Soviet Machinery Plants

Construction work on a new plant for the building of automatic machines, presumably of the multiple-spindle type, has been begun at Kiev, Soviet Russia. The plant will be completed in about two years and is designed to have a capacity of 1500 machines a year. Construction of a new typewriter factory has also been started at Kazan. The output of this plant, when completed, will be 30,000 typewriters annually.

Electric Furnaces for Malleableizing

According to recent tests made by Westinghouse engineers, malleable iron from electric furnaces permits a reduction in over-all machining costs of one-third, as compared with the best malleable iron obtainable from the usual fuel-fired process. It is stated that the tests show more than $100 worth of saving in tool life and machining cost per ton of small draw sockets. The castings are said to be very uniform in machining qualities because of the precise control possible with the electrical malleableizing process.

Great Britain Develops New Air Liner

What is claimed to be the fastest four-engined air liner in the world was recently tried out at Hatfield, England. It is the first of twelve machines, five of which are for the Singapore-Australia section of the London-Australia air route, and seven for air services in Great Britain. These planes have a maximum speed of 170 miles an hour. With fuel for four hours, they have a range of about 600 miles, carrying a pay load of 1500 pounds. With one engine out of action, fully loaded, the machine

has a ceiling of 15,300 feet, while it has a safety margin of being able, with any two of its four engines stopped, and with full load, to fly at 3600 feet.

Huge Generators Furnished to Russia Exceed Their Guarantees

Tests conducted by U S S R engineers have shown that the five hydro-electric generators furnished by the General Electric Co. for the hydro-electric development at Dnieprostroy, in Russia, exceed the guarantee of their efficiency. It is believed that this is the first time that a foreign installation of apparatus in the Soviet Republic, taken under a penalty and bonus contract, has exceeded the guarantee and the manufacturer earned a bonus. The generators are 77,500 K.V.A. The full-load efficiency guaranteed was 97.87 per cent. The actual measured efficiency is 97.91 per cent. This means that the power plant will produce from 200 to 400 kilowatts more than expected with the five machines, according to the load conditions.

Increase in Aerial Transportation of Merchandise

The number of shipments forwarded by air express by the Railway Express Agency more than doubled in 1934, as compared with the previous year, and there was an even greater increase in the actual tonnage handled. Considerable reductions in rates have been made during the year. At present, the minimum charge is 85 cents for a package weighing 3/4 pound, and $1 for packages weighing one pound. These rates apply between any two points on the Railway Express Agency air system, which includes more than 120 airport cities in the United States and the routes of 14 commercial airline operating companies. The average distance that each package was forwarded was 1100 miles.

A Luminescent Paint for Industrial Use

Sulphur of calcium has the peculiar quality, after having been exposed to natural or artificial light even for a short space of time, of giving off in the dark a luminosity which lasts for about twelve hours. This property has been made use of in the preparation of a new luminescent paint known as "Dialux," the principal element of which is sulphur of calcium. Dialux, a product of the Grobet File Corporation of America, New York City, is used to show the position of objects in complete darkness.

Many uses in shops and factories suggest themselves as, for example, for fire extinguishers, hydrants, electrical switches, projecting objects, staircases, and dangerous dark corners. Dialux paint is permanent. The luminescence of painted surfaces can be restored time and time again simply by exposure to light. In other words, the sulphur of calcium acts as an accumulator of light. It is charged by exposure to light, and then slowly discharges during a period of from twelve to sixteen hours.

New Device Measures Depth of Sea by Echoes

According to the *Nickel Bulletin*, London, a new form of recording device that measures the depth of the sea by an echo, has been devised by British engineers. This device utilizes a core of circular nickel stampings which is fastened to the side of a ship just below the water line. The core generates sound waves which are induced magnetically. These sound waves are carried to the bed of the sea, from which they are reflected back to the ship. This reflection of the sound waves, or echo, is caught by another nickel core and converted back into electrical pulsations. By measuring the time elapsing between the transmission of the sound and the reception of the echo, the depth of the sea can be calculated.

Welding together the Ends of a Rolled Stator Frame for a Motor in the Westinghouse Plant in East Pittsburgh

EDITORIAL COMMENT

"It is time to begin to preach the philosophy of courage and success," said a manufacturer and engineer recently who has had to face a great many difficulties during these depression years. "We have had enough of the philosophy of defeatism and failure. Let us turn to the idea of overcoming our difficulties—the idea of those early Americans who made this country possible."

Going Ahead in Spite of Obstacles—a Good American Doctrine

This sounds like good doctrine. Certainly it is useless to sit down and wait, hoping that things will be better. Those who will win out are the men who recognize the difficulties created by unwise laws, heavy taxes, and economic and governmental restrictions in industry, and still say, "This is all very discouraging. But the world has always had lots of difficulties, and has made progress in spite of them. So let us just go ahead."

Now, this manufacturer was not simply talking. He has been practicing what he is preaching, and as a result he has been able to successfully pass through these lean years in one of the most difficult branches of the machine-building industry. It is gratifying to record that there are a great many men in the machinery industry who have faced the depression in the same spirit.

The engineer is likely to overestimate the value of mere technical ability and engineering knowledge. To be sure, such ability and knowledge is of the greatest importance, because upon it depends the smooth working of the mechanism that we call civilization. But mere technical ability does not insure results. A good engineer is not always a good executive; the test of a good executive is the ability to get important work done with the minimum of delay and cost.

A Successful Engineer Must Also be a Good Executive

Many an able engineer can carry out his own work to perfection, but he is not able to coordinate his work with that of others, to cooperate to a common end, and to adjust himself and his work to that of his co-workers when the final result demands such adjustment. That is why we often find the work of engineers of acknowledged ability directed by men who are not their equals as engineers, but who have superior executive qualifications—that is, men who can keep the business machine going smoothly by coordinating the work of others, thereby achieving commercial results. For, after all, it is commercial results that buy bread and butter in a commercial world; and the successful engineer must be able to strike a balance between engineering perfection and commercial requirements.

While it is not likely that national planning of the operations of industry can ever be successful in a democracy, there is no argument as to the need for careful planning in an individual industrial enterprise. Many firms in the machinery and kindred fields have been basing their business policies on annual planning and budgeting for many years.

Where Planning and Budgeting Have Proved Their Value

In one well-known machine-building plant, the work of every department is carefully planned a year ahead. The number of machines to be built in each production department is estimated, the redesigning to be done in the engineering department is determined upon, and the amount of advertising and the number of new catalogues to be handled by the publicity department are specified. Selling quotas are determined upon for the different territories throughout the country.

All this, after having been planned in considerable detail, is put down in writing and adhered to as closely as possible throughout the year. Any changes from the predetermined plan that may seem desirable are considered with extreme care and made only when it is deemed absolutely necessary. In one year, the sales of a certain company following such a planning system were 93 per cent of the sales estimated twelve months in advance, and, in the case of another company, 97 per cent. Considering the large number of factors that influence results throughout the year, these two firms did a good job of planning.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

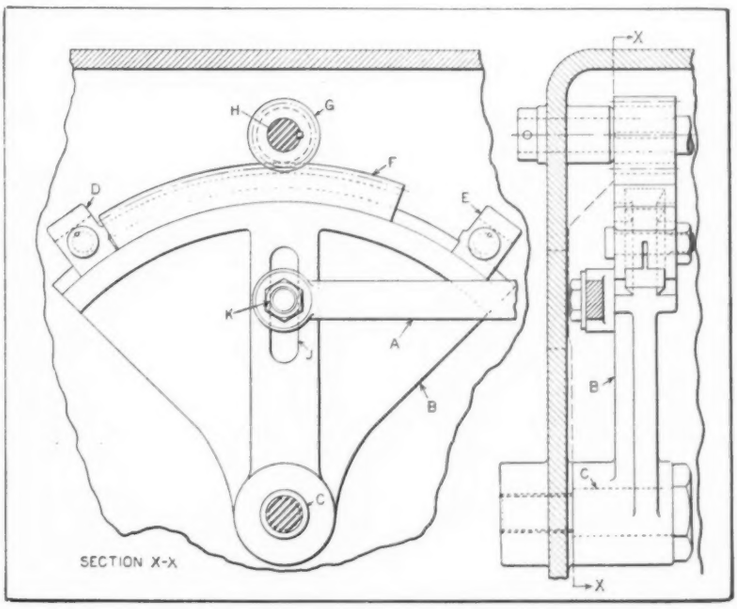
Rotary Reversing Mechanism for Varying Angular Movement and Dwell

By J. E. FENNO

Wire-forming machines of the four-slide type usually have various ingenious mechanical movements incorporated in their design that are applicable to machines used for other purposes. For example, in one four-slide, wire-forming machine, there is a reversing movement for a feed-slide shaft that has unusual features. This mechanism is designed to give the driven shaft a short dwell at each point of reversal. Besides, provision is made for varying the angular movement of the driven shaft without altering the dwell. The movements are transmitted from another shaft which oscillates continuously at a constant angular velocity.

On the oscillating driving shaft (not shown) is an arm to which is connected the link *A*. This link in turn, is pivoted to the sector or segment *B*. Sector *B* is free to oscillate on the stationary stud *C* and is provided with a sliding gear sector *F* which meshes with the driven gear *G*. Sector *B* is also provided with adjustable split stops *D* and *E*. These stops are used for regulating the angular movement and the dwell of the driven shaft *H*, to which gear *G* is keyed. The stops are clamped in place by bolts on the dovetailed periphery of the sector *B*.

An important part of the mechanism is a friction stop or brake on shaft *H*, which is necessary to prevent over-run of this shaft at the point of reversal. The brake arrangement, however, being of simple and well known design, is not illustrated.



Mechanism for Imparting Rotary Oscillating Movement to Shaft H, which Permits Varying Angular Movement and the Length of Dwell at Each Reversal

When the machine is in operation, the sector *B* is oscillated by link *A* at a constant angular velocity. In the position shown, the sector has moved toward the right to its central point, rotating gear *G* in a counter-clockwise direction. This motion continues until the sector has reached its farthest position at the right.

The sector then reverses its movement and the rack *F* and gear *G* remain stationary until the end of the rack comes into contact with the stop *E*. At this time, continued movement of the sector toward the left will carry the rack segment toward the left, rotating gear *G* in the opposite direction. The rotary movement of this gear continues until the sector comes to the end of its movement toward the left.

Now as the sector once more moves toward the right, gear *G* dwells until stop *D* comes in contact with the sliding gear segment. Thus, gear *G* and shaft *H* are given a rotary reciprocating motion with a short dwell at each point of reversal. Owing to the different kinds of jobs adapted to this machine, a variation in the angular movement of shaft *H* is frequently required, the dwelling period remaining constant. This is obtained by the combined adjustment of the link and the stops. The extent, however, to which the angular movement can be increased is limited by the length of the sliding gear segment.

Suppose, for example, a greater angular movement of the shaft were required. In this case, the stud *K* would be adjusted to a lower point and stops *D* and *E* would be moved farther apart to avoid reducing the time periods of the dwells. In making these adjustments, a few trials are

usually necessary in order to obtain the proper positions of stud *K* and the stops. Obviously, the same arrangement can be used to reduce or increase the dwell within certain limits, the angular movement of the driven gear remaining the same.

Mangle Gear Mechanism for Changing Direction of Rotation

The mangle gearing mechanism shown in Fig. 1 is designed to drive, from a continuously rotating shaft *P*, a shaft *S* a portion of a turn backward and forward. The pinion shaft *P* is driven through universal joints which permit it to move back and forth in the slot in guide *B*. To the shaft *S* is keyed a center plate to which is attached concentrically the mangle gear proper, consisting of a ring of cast iron or steel fitted with a number of pins which act as gear teeth and which mesh with the teeth of a gear of the sprocket type.

To the center plate is attached a reversing dog or guide *D* into which the end of the sprocket shaft passes, restricting the movement of the sprocket, and causing it to move from one side of the pin ring to the other as the sprocket and ring rotate together. After the passage of the sprocket from one side of the ring to the other, the ring turns in the opposite direction; that is, its motion is reversed, but its velocity remains unchanged, except, of course, during the passage of the sprocket to the other side of the ring while it is in contact with guide *D*. In passing through the guide, the end of the sprocket shaft travels from one end of the slot

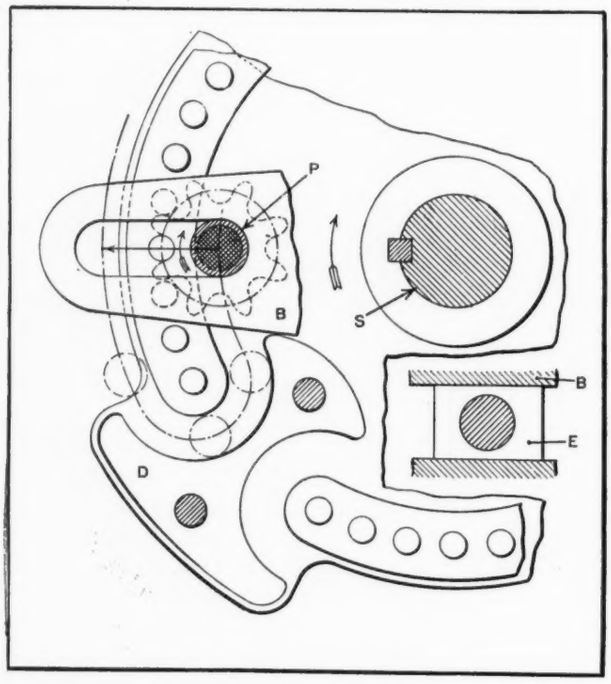


Fig. 1. Pin Type of Mangle Gearing for Reversing Rotation of Driven Shaft S

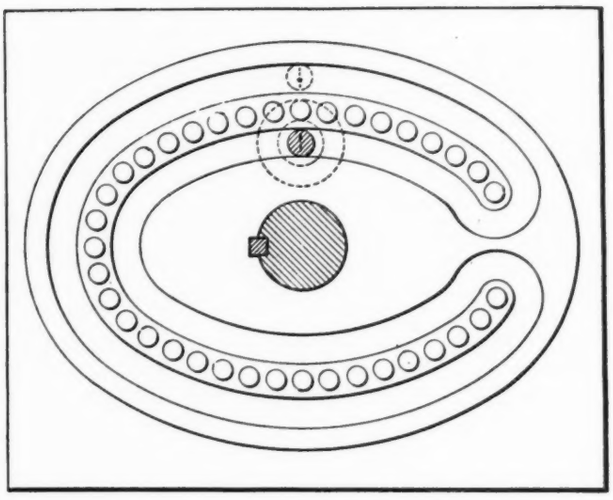


Fig. 2. Reversing Mechanism Similar to that Shown in Fig. 1, but Designed to Produce Variable Velocity

in the fixed bracket *B* to the other. The ends of the slot prevent the sprocket from being forced out of mesh with the pins. When the center plate has rotated through its full complement of a turn, the sprocket is again transferred to the side of the ring with which it was previously in mesh through the action of the opposite guide.

Instead of rotating directly in the bracket *B* as a bearing, the shaft may rotate in a sliding block *E*, such as shown in the small cross-sectional view.

In Fig. 2 is shown a variation of the type of mechanism just described. This design is arranged to vary the velocity of the driven shaft. The end of the pinion shaft may be fitted with a ball journal bearing.

B. M.

Long Rectilinear Movement Having Constant Velocity and Rapid Reversal

By F. E. JUDSON

In a certain type of can-seaming machine, the work is controlled by a mechanism having a continuous reciprocating movement. This mechanism provides a relatively long traverse movement of constant velocity. The reversals are positive and practically instantaneous. The accompanying illustration shows at a glance the compact nature of the mechanism. The compact feature was essential in this instance, because the mechanism was used in making an alteration to a machine where the small space available made it impossible to use a long-throw cam. A nut and feed-screw provided with the usual dog-operated reversing mechanism was considered, but was rejected owing to the lost motion attending each reversal.

The mechanism shown is mounted on the machine frame *A* and consists essentially of the two worms *B* and *C* and the follower-roll *D*. Both the worms have right-hand threads and are rotated at

a constant velocity in opposite directions by means of gears *E* and *F*, mounted on their respective worm-shafts. These gears, in turn, are rotated by gear *G* on the shaft *H*, which is driven by another member of the machine.

Follower-roll *D* is free to turn on its bearings in cross-slide *K*, which moves laterally in the slide *J*. Slide *J* is mounted on a dovetail guide on the machine and transmits the required movement to the work. This slide is given a reversal of its movement at each end of its stroke through the action of cam lugs *L* and *M*, secured by screws to opposite ends of worms *C* and *B*, respectively.

The roll is held in engagement with each worm by the insert *N* which rides along one side of stationary bar *O*, depending upon which worm is engaged with the roll. Bar *O* is held in the stationary position by the top plate *P*, secured to the bearings of the worm-shafts.

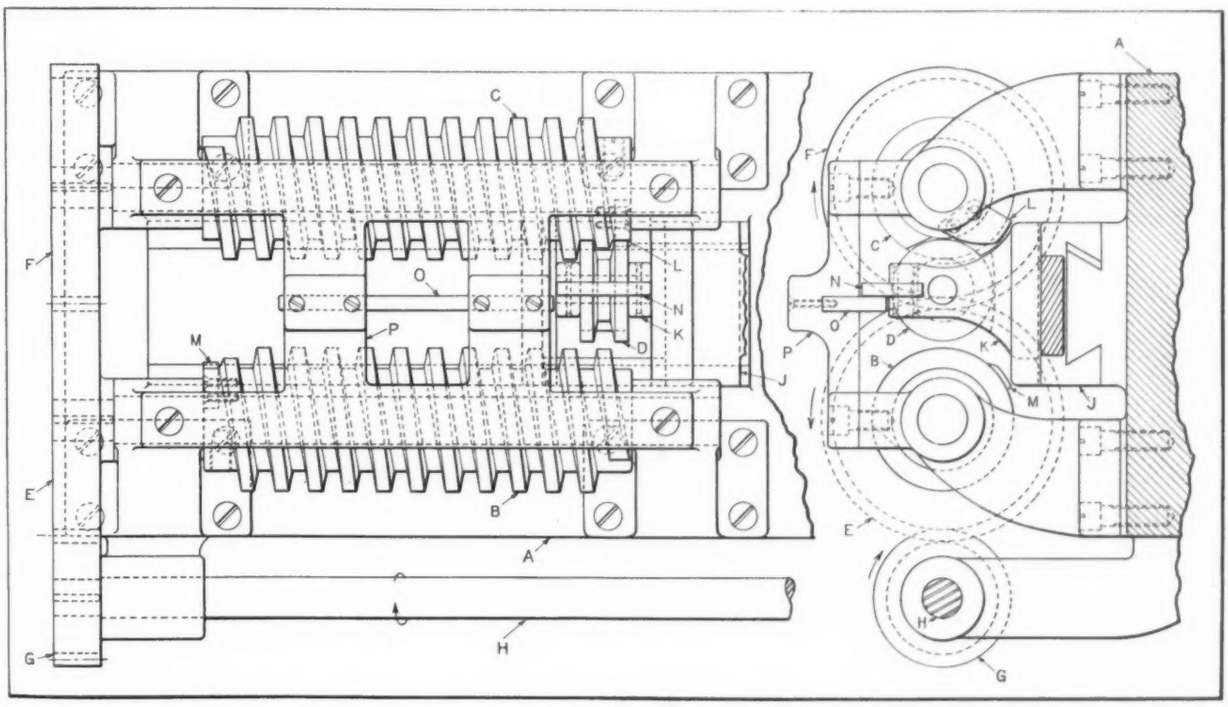
When the follower-roll has reached the position indicated, slide *J* is at the end of its right-hand stroke. It will be noted that insert *N* on the roll cross-slide has just passed the end of bar *O*. Now as the worm continues to rotate, the cam lug *L* comes in contact with one flange of the roll and forces it over into engagement with the beginning of the thread on worm *B*, holding or locking it in this angular position until the worm thread has carried the left-hand end of the insert *N* past the right-hand end of bar *O*. Worm *B* then reverses the movement of the follower with slide *J*, carrying it toward the left until, at the end of the stroke, cam *M* comes into contact with the other follower-roll flange, which forces the latter over into engagement with worm *C*.

The roll is held in this position until its movement toward the right carries insert *N* past the end of bar *O*, the bar preventing disengagement of the roll and worm during the remainder of the stroke. Thus worm *C* returns the roll and slide *J* to the position shown, where the reversal of the slide *J* is repeated. The reversals of slide *J* are effected rapidly and with absolutely no shock. The pressure between insert *N* and bar *O* is insignificant, owing to the relatively small angle of the worm thread. However, in order to insure a long life, as well as to increase the efficiency of the unit, both of these members are hardened and ground on their wearing surfaces.

* * *

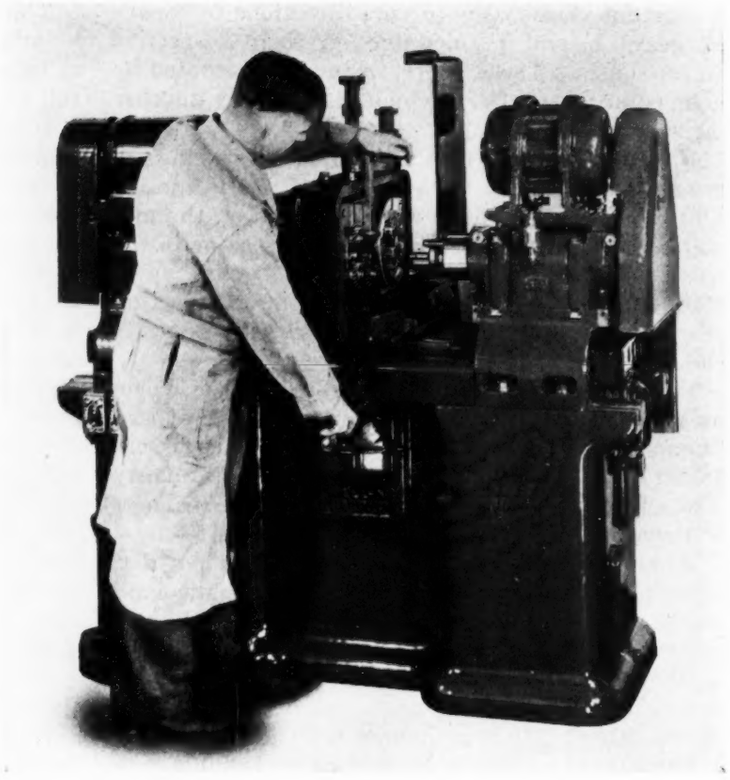
Testing Materials Society to Meet in Detroit

The American Society for Testing Materials will hold its thirty-eighth annual meeting in Detroit during the week of June 24 to 28, with headquarters at the Book-Cadillac Hotel. Sixteen sessions are scheduled for the convention. In addition, during the five days of the annual meeting, the Society's third exhibit of testing apparatus and related equipment will be in progress, at which the latest developments in the testing and scientific instrument field will be on display. Besides displays by leading companies in the testing apparatus field, the exhibit will include non-commercial apparatus developed by committees of the Society or research laboratories for carrying out special tests and research work.



Mechanism for Obtaining Rectilinear Movement with Rapid Reversal at Each End of Stroke

Precision Boring as a Production Operation



The Use of Diamond and Cemented-Carbide Tools Has Created the Need for Boring Machines of the Precision Type—First of Two Articles

By C. A. BIRKEBAK, Engineer
The Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich.

THE boring of holes within limits of plus or minus 0.0001 inch is no longer confined to the tool-room. It has become regular practice in many shops through the application of machines of the precision boring type. The realization that tungsten-carbide and diamond tools could bore holes to extreme accuracy and with unexcelled smoothness if proper machines were available, led to the development of this class of equipment. Precision boring machines are designed with the utmost rigidity to prevent chatter of the tool against the work. They are adapted for revolving the work or the tool at a high surface speed and for feeding at a fine rate during the actual boring.

Precision boring has been applied on a high-production basis to a wide variety of materials. This article will describe a number of operations performed on Ex-Cell-O hydraulically operated machines. In these operations, tungsten-carbide tools are used for machining cast iron, brass, and mild steels; tantalum-carbide tools for the tougher steels; and diamond tools for aluminum, and other non-ferrous materials.

Various set-ups have been designed for boring bronze bushings in automobile transmission gears. In Fig. 1 is shown equipment provided for finish-boring three cluster gears simultaneously from each end. The hole is 7/8 inch in diameter by 1 1/4 inches long. Diamond tools are used for this operation, the depth of cut being from 0.005 to 0.006 inch, the feed 0.0015 inch, and the speed of the six boring spindles, 3500 revolutions per minute. In this operation, 128 gears are bored an hour.

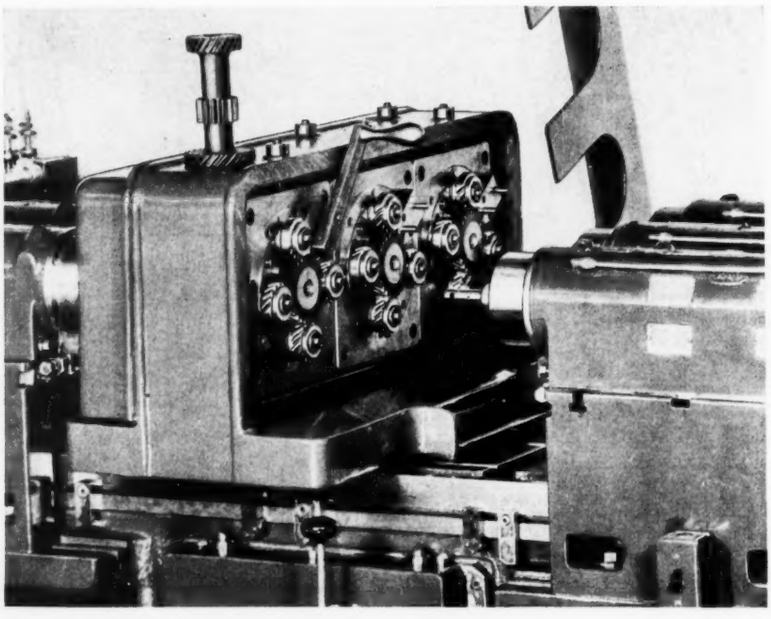


Fig. 1. Automobile Cluster Gears are Accurately Bored from Both Ends, Three at a Time, with this Equipment

The work fixture first moves to the left-hand tool-spindles for boring the gears from the left-hand end and then to the right-hand tool-spindles for boring the holes in the opposite end, after which it returns to the center of the machine and stops for reloading. All movements of the table on which the fixture is mounted are effected hydraulically. Garrison duplex gear chucks locate the cluster gears accurately from the pitch diameter. The gear chucks are operated by means of a crank-lever, as shown on the face of the front chuck.

The heading illustration shows a two-station machine arranged for boring the bronze bushings in two different cluster gears at the same time, the operation being again performed from each end. Garrison gear chucks are employed in this operation also to insure that the holes will be bored concentrically with the pitch circles of the gear teeth.

Three Pieces Bored and Another Faced in One Machine

Four separate parts are handled by the machine illustrated in Fig. 2. The operations consist of finish-boring a refrigerator compressor housing, a compressor end-bell, and an air valve, and of facing a compressor seal. In the operation on the compressor housing, two cylinders are bored in the iron casting and a bronze bushing is finished for a crankshaft. The cylinders are bored consecutively at the back of the machine by tools held on the spindles of heads at opposite ends of the machine. Then the part is transferred to the front of the fixture for boring the bronze bushing by means of a second unit on the right-hand bridge. Through the use of a suitable adapter, the bronze bushing in the compressor end-bell is also bored by this unit, but in a separate operation.

The bronze bushing in the air valve is bored with the part held on the left-hand side of the fixture at the front, the cut being taken by the front boring unit on the left-hand bridge.

Mounted vertically on the front of the machine is a fifth spindle unit *A* equipped with a quill type chuck for holding the bronze compressor seal. This seal is faced by means of a tool held in bar *B*. At the end of the boring operations performed by the units on the left-hand bridge, the facing tool *B* is lowered in line with the work by means of a hydraulic cylinder on the fixture and the facing cut across the compressor seal is taken while the carriage of the machine is returning to its central position on the bed.

Tungsten-carbide tools are used in boring the cylinders of the compressor housing, but diamond tools are employed for all other cuts. The depth of all boring cuts averages 0.005 inch, while the facing cut is taken at a depth of 0.006 inch. In boring the cylinders, the boring spindles run at 1200 revolutions per minute, but in the other boring cuts the boring-spindle speed is 3500 revolutions per minute. The tungsten-carbide tools are fed at the rate of 0.003 inch, and the diamond tools at the rate of 0.001 inch.

In the cylinder-boring operation, the production is 32 pieces an hour; in the boring operation on the crankshaft bearing, 87 pieces an hour; in boring the compressor end-bell, 90 pieces an hour; in boring the air valve, 85 pieces an hour; and in facing the compressor seal, 120 pieces an hour.

Boring Operations on Differential Carriers

The cross-holes in automobile differential carriers are bored to a diameter of from 3.1496 to 3.1506 inches by means of the equipment shown in Fig. 3. Tungsten-carbide tools are used in this case, as the part is an iron casting. The depth of cut ranges from 0.006 to 0.0075 inch, and the feed is 0.003 inch. The boring spindles run at 500 revolutions per minute. Thirty-five pieces are completed, on an average, per hour.

The work is located on two dowel-pins that register in previously reamed holes in the flange. The flange is held firmly on three buttons by hook type clamps which are operated and locked by the crank-handle on the front of the fixture. The work is first fed toward the left-hand tool-spindle for finish-boring one hole, and then toward the right-

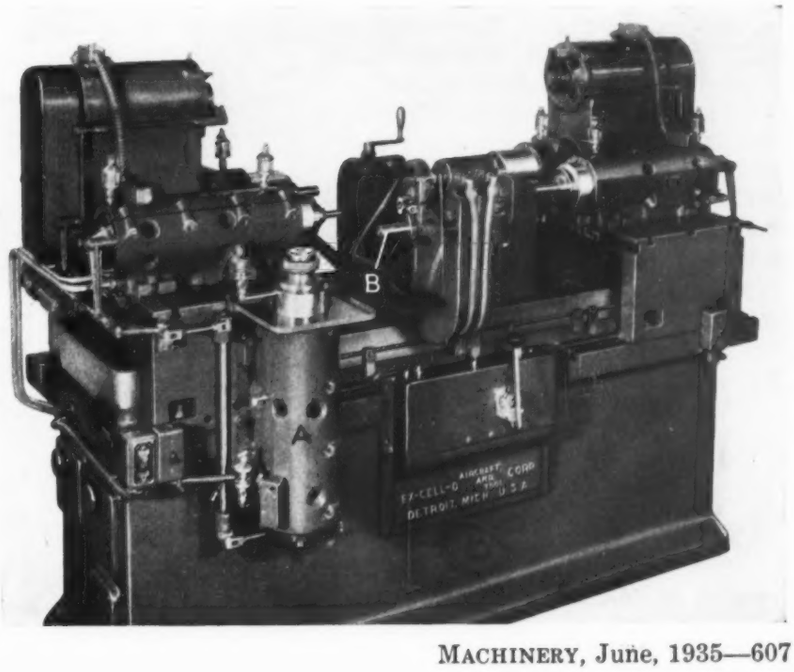


Fig. 2. Three Parts are Accurately Bored and a Fourth Faced on this Double-end Precision Boring Machine

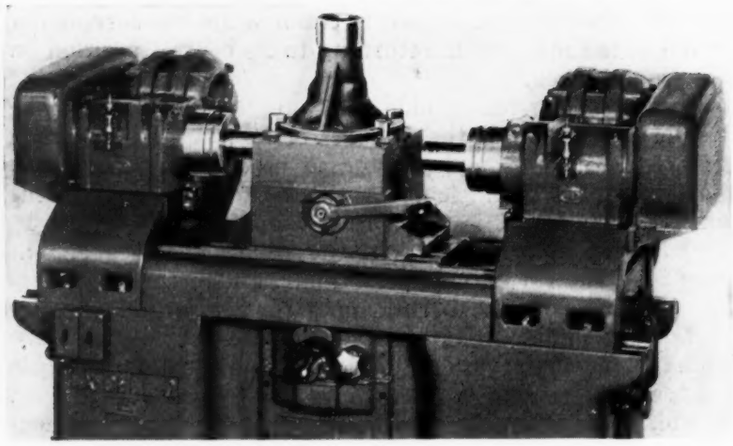


Fig. 3. Precision Boring Machine Arranged for Finishing Two Holes in Differential Carriers within a Tolerance of 0.001 Inch

hand spindle unit for finish-boring the second hole. Two boring tools are provided on each spindle. The movements of the work carriage are effected hydraulically.

Finish-Boring Crankshaft Bearings and Cylinder Holes in Refrigerator Crankcases

The two-station fixture seen on the single-end machine illustrated in Fig. 4 is designed for finish-boring two crankshaft bearings and two cylinder bores in refrigerator crankcases. The crankshaft bearings have a diameter of 1.016 inches and 0.688 inch, respectively, while the cylinder bores are finished to a diameter of 1.500 inches. In boring these holes, the depth of cut ranges from 0.004 to 0.006 inch. The feed used in boring the crankshaft bearings is 0.002 inch, and in boring the cylinders, 0.003 inch. The boring spindle runs at 1520 revolutions per minute in machining the crankshaft bearings, and at 950 revolutions per minute in the cylinder-boring operations. Thirteen crankcases are finished complete per hour, tungsten-carbide tools being employed.

The crankcase is first placed in the station at the back of the fixture for boring the two crankshaft bearings in one operation with two tools mounted on a long piloted bar. This bar is driven by one of the boring units mounted on the bridge at the left-hand end of the machine. The work is located by seating it on a large dowel and clamping the finished bottom face on three pads.

For boring the two cylinders, the casting is placed in the station at the front of the fixture. This station is provided with a cross-slide to permit indexing the work for boring the two cylinders with one tool-spindle. The casting is located vertically by a bar that is passed through the finished crankshaft bearings and by a finished pad directly beneath the cylinder bores. It is located sidewise from one of the rough cylinder bores. Pressure is exerted on top of the work by means of a swinging clamp.

Other examples of precision boring operations will be described in the second installment of this article, to be published in a coming number of MACHINERY.

* * *

A New Type of Plating Anode

A new anode known by the trade name "Zam" (derived from the words zinc, aluminum, and mercury), has been developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J. This new anode is not attacked by either acid or cyanide solutions until the current is applied. Thus it will be free from sludge, which can be completely used up in a zinc solution. As no sludge will be found in the bottom of the tank nor on the anode, practically no increase of voltage will be required at any time, either at the start or during the plating, whether the run is short or long. This permits setting the rheostat at the required point with the assurance that the desired amount of zinc will be deposited in a given time. The new anodes have been used advantageously by many prominent manufacturers.

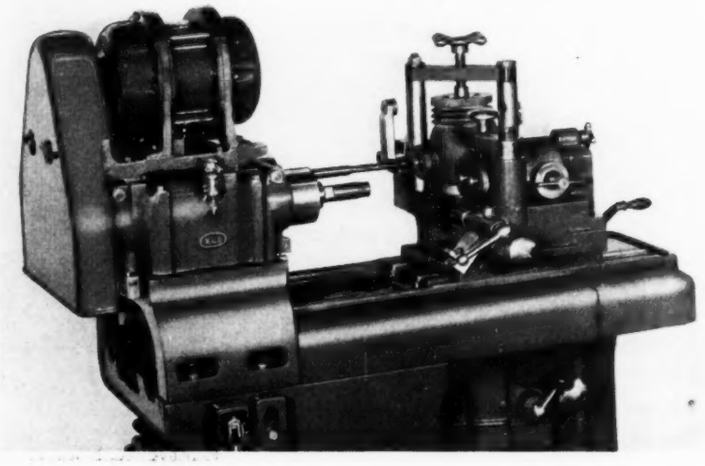


Fig. 4. Single-end Machine with Two Boring Heads for Boring Crankshaft Bearings and Two Cylinders in Refrigerator Crankcases

Welding Improves Coal Loading Equipment

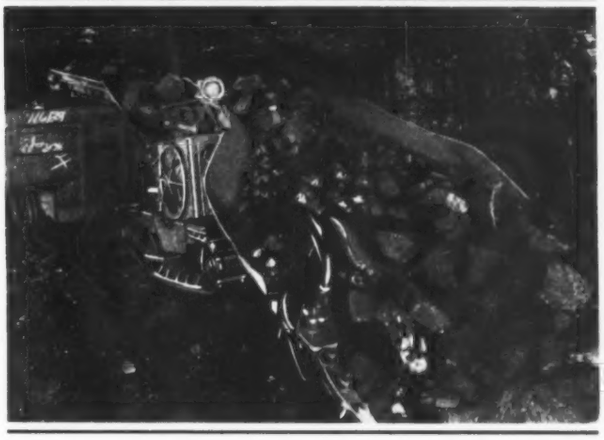


Fig. 1. A Coal Gathering and Loading Machine that Sweeps up Coal in a Mine at the Rate of Two Tons a Minute. It is Obvious that These Machines are Subjected to Rough Usage. The Strength and Rigidity have been Greatly Increased by Arc-welded Construction

SELDOM is mechanical equipment subjected to such severe service as it is in coal mines. This is particularly true of coal gathering and loading machinery. In order to meet these conditions satisfactorily, the Joy Mfg. Co., Franklin, Pa., adopted arc welding in the construction of gathering heads for its coal loading machines. The severity of the service to which these parts are subjected can be appreciated from Fig. 1. At times the gathering heads are covered with four or five tons of coal. With the old type of construction, the severe service caused the parts to become loose.

Welded construction makes the gathering heads into one solid unit. Not only does arc welding provide more rigid construction with less weight, but it also permits of simplified design, which makes possible worthwhile manufacturing economies.

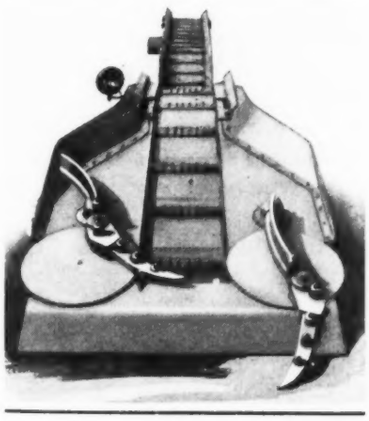


Fig. 2. (Above) The Old Type of Gathering Head of Riveted Construction

Fig. 3 shows a new design of heavy type loader built by this company. These gathering heads carry powerful rotating arms which sweep the coal into conveyors at the rate of two to four tons a minute, for delivery to the mine transportation system. The heads are over 6 1/2 feet wide, over 8 feet long, and about 17 inches deep, and are fabricated from 3/8-, 7/16-, and 1/2-inch plate. Each head weighs approximately 2000 pounds complete. To increase resistance to extreme abrasive action, the lip of the gathering head is made of alloy steel.

In the construction, the gathering head is provided with enough holes for bolting the frame together before welding. Some of the bolts are removed after the frame is welded. Approximately 170 linear feet of welding is done on each gathering head, with equipment manufactured by the Lincoln Electric Co., Cleveland, Ohio. The rear conveyor frame, which is approximately 3 feet wide by 14 feet long, is also of arc-welded construction. Arc-welding equipment is used for refacing the lips of the gathering heads, in case they become worn.

The interest of the designer engaged in the machine-building industry in general in this and similar developments is mainly because of the ideas suggested by these applications. Welding has made a decided place for itself where strength and ruggedness are paramount.

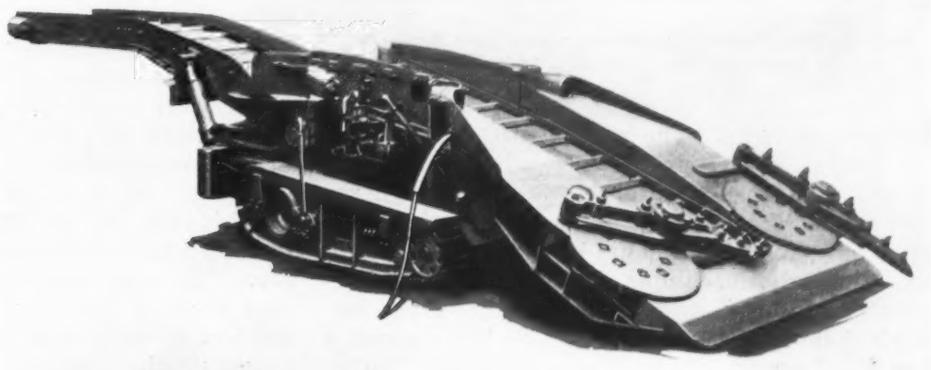


Fig. 3. (Right) Modern Gathering Head for a Coal Loading Machine of All-welded Construction

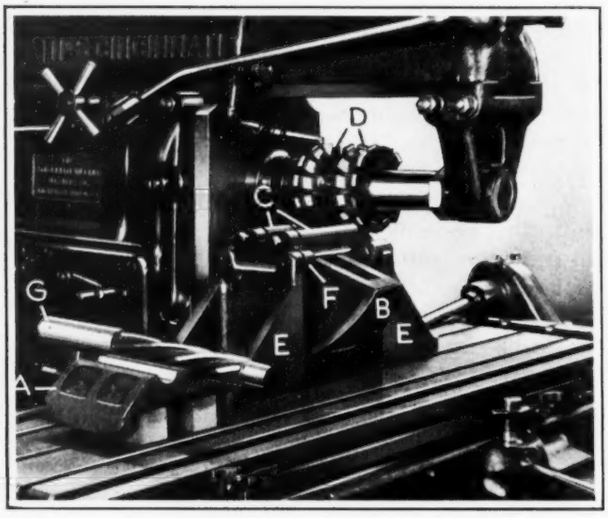
Milling Semicircular Surfaces to Fit Each Other

By OLIVER HERBERT

The trailer trucks of Mountain and Pacific type engines used by the Grand Trunk Railway System are equipped with a constant-friction centering device. This device includes the two parts shown at *A* and *B* in the illustration. Member *B* has two semicircular bearings *C*, 2 inches in diameter by about 5 inches long, which rotate in corresponding seats in block *A*. The bearings and seats of these parts must fit each other snugly, and their center-to-center distances are required to be held within close limits.

The illustration shows equipment designed in the Battle Creek, Mich., shops for machining the surfaces mentioned. With member *B* supported as shown, two formed cutters *D* mill the bearings the required distance apart. Brackets *E* are used for all jobs. To these brackets are attached false plates, as seen at *F*, which have holes tapped in them to suit the center distance between the bearings of the particular member *B* that is being handled. Studs which are screwed into the tapped holes enter holes in the bearings of member *B* to support it.

The semicircular grooves are produced in part *A* by clamping it to blocks held on the machine table

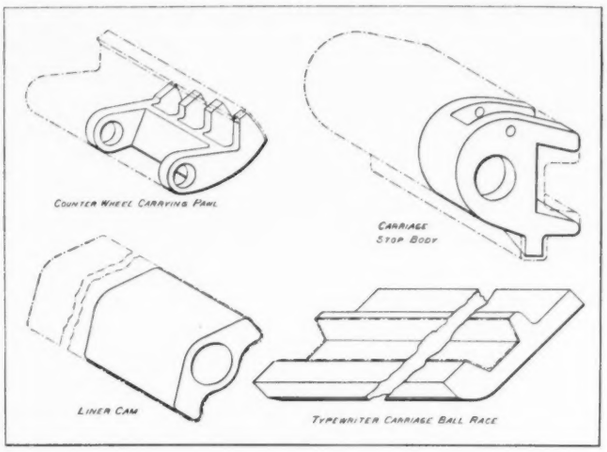


Railway Shop Milling Operations which have Replaced Previous Time-consuming Methods

and using cutter *G*. The required distance between the grooves is, of course, conveniently obtained by moving the table the proper amount through the feed-screw. The milling of member *B* takes 1/2 hour, as against 1 1/2 hours by the previous method. Similarly, machining the seats in part *A* requires 15 minutes, whereas with the practice formerly followed, the time taken for this operation was 1 1/2 hours.

Making Cash-Register Parts from Cold-Drawn Steel Sections

The accompanying illustration shows four examples of the use of special-shaped steel stock for cash register parts, as employed by the National Cash Register Co., Dayton, Ohio. Although the stock is drawn to shape, the surfaces on which the



Four Parts for Cash Registers Made from Steel Bars Drawn to Special Shapes to Suit the Work to be Produced

dimensions must be held to very close limits are machined. The solid lines show the finished piece, while the dot-and-dash lines indicate the original drawn stock and show where it has been machined.

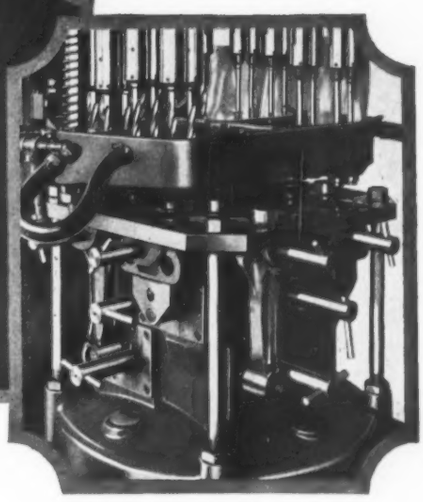
The National Cash Register Co. finds that a considerable saving can be made by using special-shaped stock rather than machining the parts completely from square-edge bar stock. It is necessary, however, in considering special-shaped stock, to be certain that the parts for which the stock is to be used will be required in sufficient quantity to warrant the expense of the drawing dies.

* * *

Soviet Purchases in First Quarter

Orders placed by the Amtorg Trading Corporation in the United States during the first quarter of 1935 totaled nearly $6,000,000, as compared with $2,200,000 in the corresponding period of 1934. Orders for industrial equipment totaled $4,309,000, of which about $3,300,000 was due to a single order for continuous sheet-rolling mill equipment placed with the United Engineering & Foundry Co. of Pittsburgh, Pa. Not only is this purchase the largest made by Amtorg in some years, but it is probably the largest single export order for metal-working equipment ever placed in this country. The mill, which has a capacity of 600,000 tons of sheet metal a year, will be shipped to the Zaporozhe steel mill located near the Dnieper power plant.

Design of Tools and Fixtures



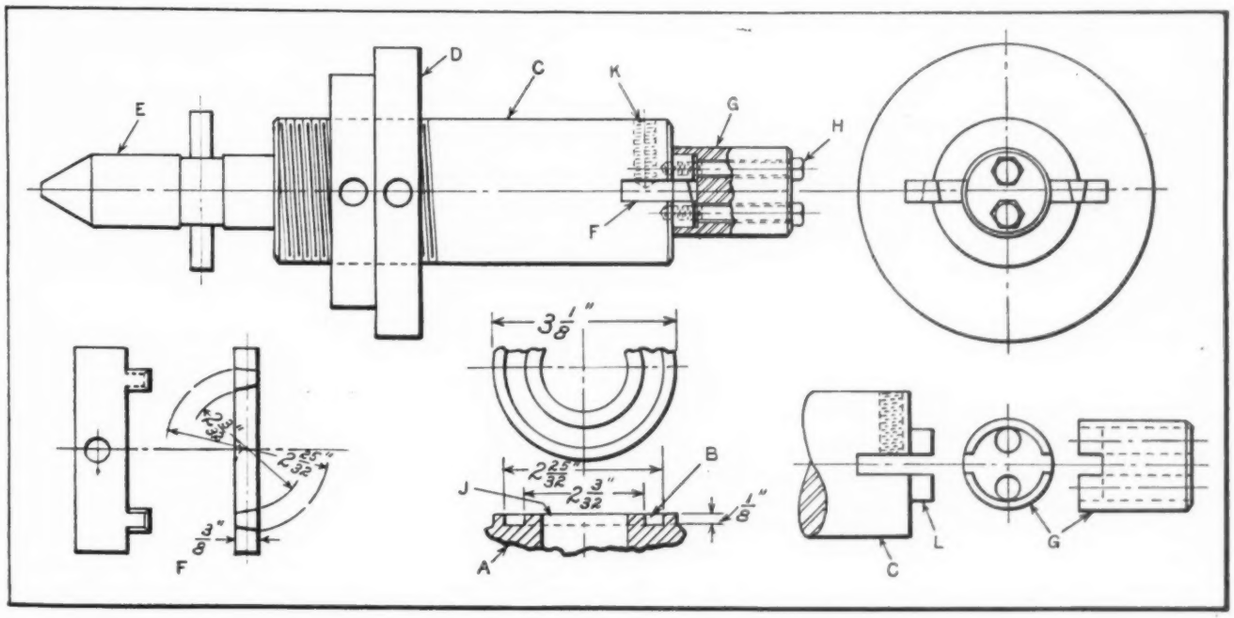
Combination Pilot and Clamp for Facing and Grooving Tool

By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Engineering Corporation, Newark, N. J.

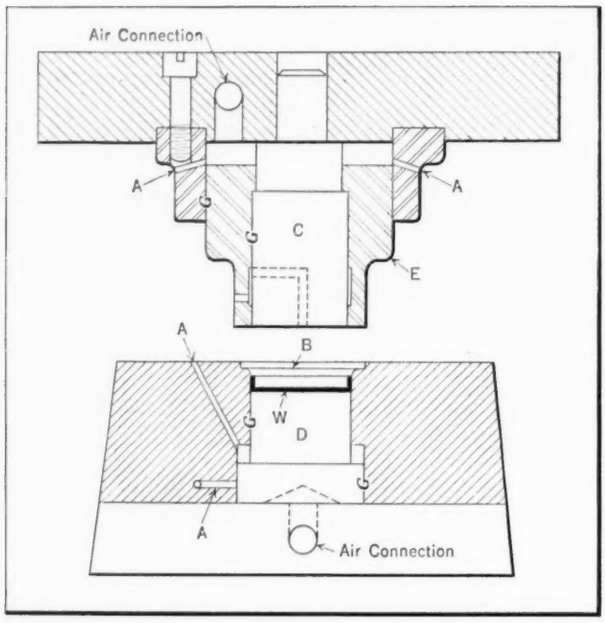
The tool shown in the upper view of the accompanying illustration is used for cutting a groove *B* in cylinder suction and discharge ports, such as the one shown at *A*. A similar tool with a straight cutting edge is used for facing the port at *J*. The groove *B* is for a lead gasket, and the mating part is turned to fit in this groove with about 1/64 inch clearance on both the inside and outside diameters. The groove serves to prevent the gasket from squeezing out after the joint is made.

The grooving tools are bored and turned in an engine lathe, using special holders, but they can also be produced by milling. An interesting feature of the tool is the combination pilot and clamp *G*, which facilitates slotting the body *C* of the holder to receive the cutter *F*. This pilot serves to keep the slotted end of the holder from spreading when the set-screw *K* is tightened.

The body *C* of the tool is made of a good grade of steel, and is fitted with stop-collars *D* which are also of steel. These collars are used to regulate the depth of the groove by adjusting them to make contact with the top of the jig plate at the proper point. The shank end *E* is made to fit a "Wizard" chuck. The end *L* of the holder is turned down to fit the counterbored end of the pilot *G* before the cutter slot is machined. The pilot is held in place by two 1/4-inch cap-screws *H*, as shown.



Tool with Detachable Pilot G for Use in Cutting Groove B in Compressor Port A



Shell-forming Die with Air-operated Strippers E and D

Using Compressed Air to Strip Shells from Forming Punch and Die

By WILLIAM C. BETZ, Equipment Engineer
Fafnir Bearing Co., New Britain, Conn.

Small sheet-metal caps can be readily ejected from the upper and lower members of a forming die by direct-connected compressed air. The size of the work that can be ejected in this way is governed by the air pressure available. As the air line pressure seldom exceeds a hundred pounds per square inch, caps up to 1 1/2 inches in diameter by 3/16 inch high, made of metal up to 0.025 inch thick, are about the maximum size that can be ejected by this method.

The die shown in the accompanying illustration is used for producing the shell *W*. The ejection of the shell is accomplished by three compressed air lines. One air line is connected to the punch member, another to the die member, and a third has a jet which blows the work to the rear of the machine into a receptacle as soon as it clears the punch or die. The admission of air to these tools is controlled by a Hannifin air valve located on the frame of the press close to the crankshaft. This valve is actuated by a cam clamped to the shaft in the correct position.

All sliding parts of the die and punch must be a close fit; otherwise, the die will not function properly. In operation, the work is placed in the nest *B*, the ram descends, and the fixed punch *C* forces the blank into the die, carrying the lower shedder or stripper *D* down with it and at the same time allowing the shedder sleeve *E* to slide upward on the punch. On the up stroke, the blank may stick on the punch or in the die, but at a given point of the ram ascent, the cam operates a valve in the air lines to both the upper and lower knock-outs and the ejector jet, causing the work to be stripped from the punch or die and blown into a receptacle at the rear of the press. This method is useful on presses having no positive stripping or shedding equipment. It eliminates the necessity for using rubber spring buffers or pressure pads.

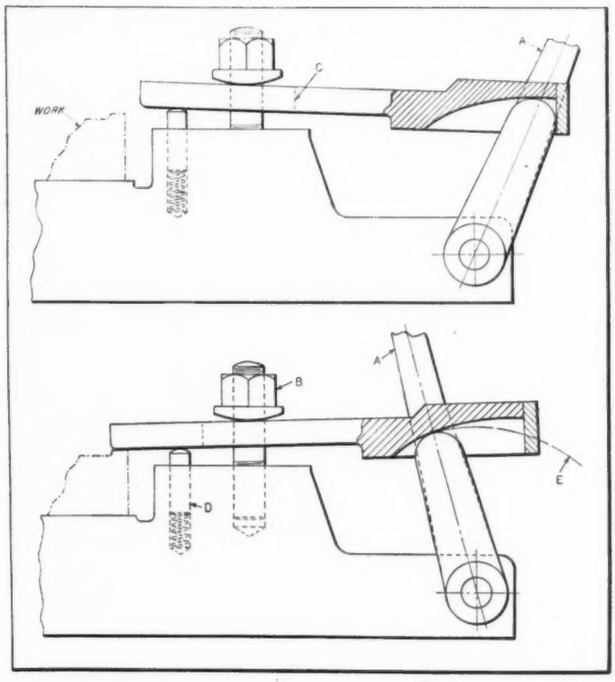
The action of the air on the ejectors forces them out at a given point. Near the end of the stroke, vents *A* are uncovered to allow the trapped air to escape. On the next downward stroke, the ejectors or shedders *D* and *E* are carried to their bottom positions without undue air resistance, owing to the small amount of air compressed in pushing the shedders back. The trapped air backs up in the tubes, relieving back pressure to a negligible point.

On some jobs it is desirable to have built-up pressure in the shedding devices, as, for instance, on a job requiring a certain amount of hold-down pressure to keep the edges of a piece from wrinkling while forming. To do this, the air vent should be omitted, which will give the hold-down ample pressure to form light stock without wrinkles.

Clamp that can be Positioned and Tightened with One Movement

By ROBERT H. HOLTON, Fitchburg, Mass.

A quick-acting clamping device, which has been found very satisfactory, is shown in the accompanying illustration. With the arrangement shown, the clamp or dog is moved to the work and tightened with one movement of the lever *A*. A single move-



Quick-acting Clamp with Self-positioning Feature

ment of the lever also serves to release the clamping pressure and withdraw the clamp. The upper view shows the clamp withdrawn to facilitate loading, while the lower view shows the clamp holding a piece of work in the jig.

By adjusting the hexagonal nut *B*, more or less clamping pressure can be applied to the work. Different lengths of stroke for different kinds of work may be obtained by changing the length of the slotted hole *C* in the clamping bar or by changing the position of the end-block, or both. Spring plunger *D* serves to hold the clamp above the work when the lever is moved to the position shown in the upper view. The path of the clamping cam is indicated by the curve *E*.

Combination Cutting-Off and Forming Die

By EUGENE L. SOLTNER, Philadelphia, Pa.

The accompanying illustration shows a type of die that the writer has had occasion to use a number of times. Considering the simplicity and effectiveness of this design, it seems strange that it has not come into more extensive use. It is a combination cut-off and forming die, and affords a rapid method of producing pieces made from ribbon stock, such as the one shown at *W*. The design is similar to the conventional side-acting die, except that the arrangement is reversed—the cams being on the die-bolster, while the forming dies or slides are mounted on the punch member.

Briefly, the die is made up as follows: *A* is the cut-off die; *B*, the cut-off punch; *C*, the stock guide; *D*, the stop; *E*, the forming punch; *F*, the forming dies; and *G*, the cams that actuate the forming dies *F*. The rollers *H* strike the cams and move the forming dies inward. The rollers are mounted on studs *I*. The forming dies or slides are retained by the plates *J*. The springs *K* (only one of which is shown), attached to the slides, and the pins *L* serve to return the forming dies to their open positions.

In operation, the material is fed into the die until it strikes the stop *D*. As the punch descends, the piece *M* pushes the material down until it is approximately parallel with the cut-off die. About this time the cut-off punch *B* severs the stock at the edge of cut-off die *A*, and forming dies *F* press the metal downward, draping it over forming punch *E*.

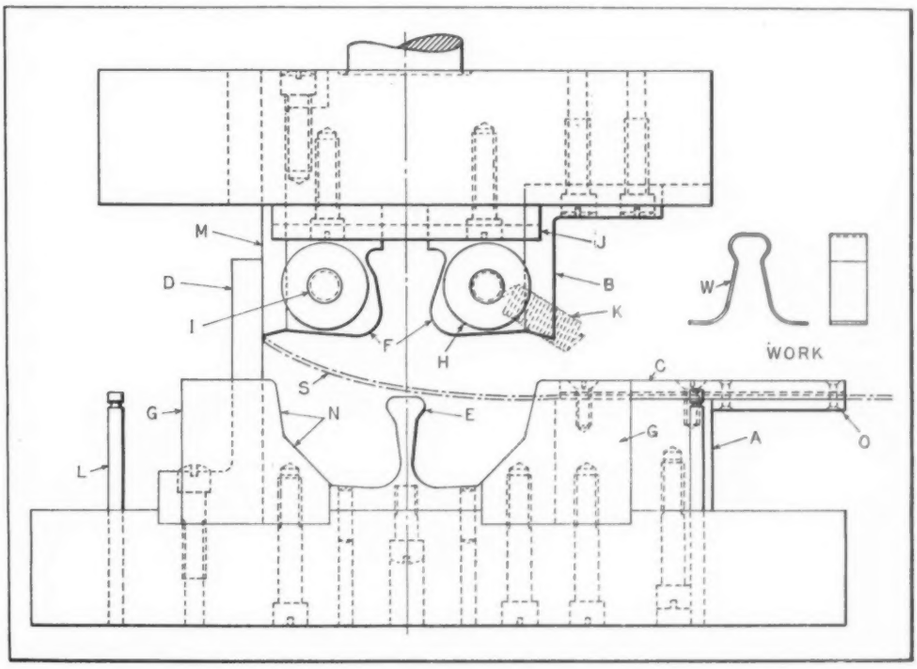
Closely following this movement, the rollers *H* come into contact with the cams *G*, and continued downward movement of the punch causes the rollers to follow the surfaces *N*. This moves the forming dies toward the punch *E* until the die is closed and the piece formed. As the ram recedes, the springs *K* pull the forming dies back to their open positions.

In connection with the use and construction of such a die, it may be well to mention several features. For example, the dot-and-dash lines show the material *S* curving upward as it enters the die. This position of the stock results from feeding the stock from the bottom side of the roll, and permits the die to bring the material to the correct position for cutting. One can visualize how much too long the piece would be if the stock were turned over.

It is very important, if good results are to be expected, that both of the dies *F* strike the material at the same instant, and that both dies should be equidistant from a vertical center line passing through punch *E*. If such is not the case, the metal will be pulled to one side, resulting in pieces of irregular length.

The piece *M* serves a dual purpose. It acts to line the stock up in a horizontal plane and also provides a back-stop for the forming die. Stop *D* overlaps the end of piece *M* when the die is in the extreme open position. This prevents the material from climbing over the stop.

In building a die of this type, the forming punch should be shaped to allow for ample spring-back.



Die for Cutting off and Forming Part W from Ribbon Stock

Then, when the die is used under an inclined press, the work pieces will be readily released from the punch and fall from the die.

Handling an Over-Size Profile Milling Job on a Medium-Size Machine

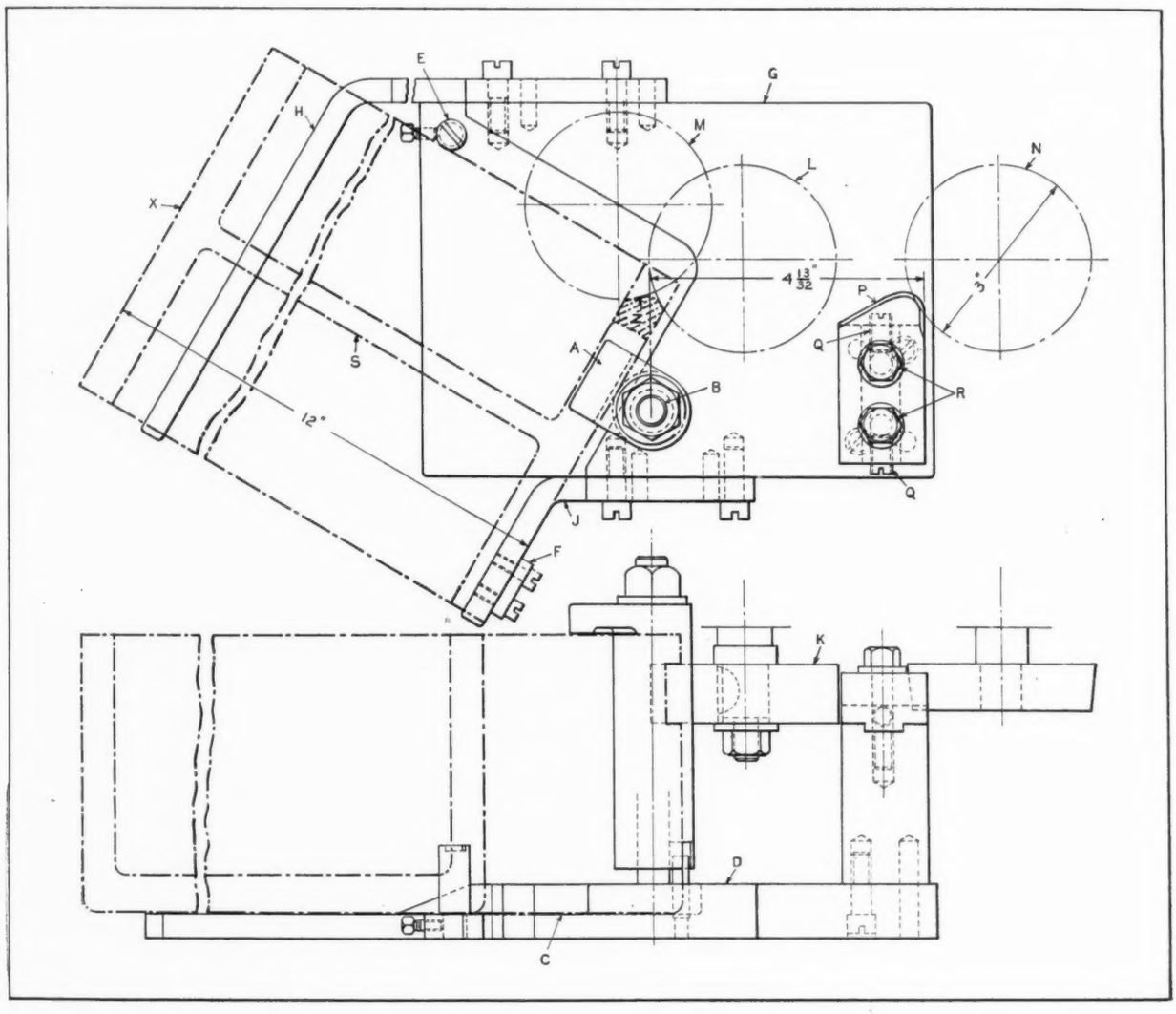
By F. SERVER

One of the characteristics of a profile milling machine is its adaptability for machining types of work that cannot be handled conveniently on other machines. A striking example of the effective use of such a machine on a piece of work too large to be mounted on the table in the conventional manner is shown in the accompanying illustration. The operation consists of milling an irregular curved notch in the work *X* at point *Z*.

The work consists of an aluminum part, both ends of which are cast at right angles to a rib *S* located between them. The casting *X* is set on the fixture diagonally, so that it will pass between the housings of the machine when clamped securely in place by the hooked sleeve *A*, which is tightened by a nut on bolt *B*. The clamp acts against the surface *C*, which is a comparatively thin base section cut down from the height *D*. It was necessary to cut this surface down in order to allow the work to pass under the cutter-spindle.

The work is located against pin *E* and plate *F*, and also against the sleeve portion of clamp *A*. The fixture base itself is made as small as practical, and is rectangular in shape, as indicated at *G*. The overhanging portion of the work is supported by an extension bar *H* and a bar *J*.

The profile milling cutter is indicated at *K*. This cutter travels around the curve *Z* from position *L* to *M*, as indicated in the plan view, when milling the complete shape. In performing this operation, the operator turns the two handles on the profile milling machine to keep the guide member *N* in contact with the formed block *P*, which determines the shape formed. The formed plate is adjusted in and out by screws *Q*, and clamped by screws *R*.



Milling Fixture with Extension Bars H and J for Supporting Large Casting in Diagonal Position

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

C. T.—What cutting lubricant is most suitable for machining K Monel metal alloy?

A.—According to the International Nickel Co., sulphurized mineral oil should be used abundantly as a cutting lubricant in machining the new alloy "K Monel." This lubricant, however, must be removed thoroughly from all parts that are to be heat-treated after machining. Blunt tools, ground to provide a good support for the cutting edge, should be used. The cutting speeds should be about one-half those used for machine steel.

Rubber Pads for Power Press Work

E. T. P.—Rubber pressure pads are frequently used in power press tools for forming and cutting metal. Is there any information available as to the area and thickness of rubber required to obtain any desired pressure in pounds per square inch?

Answered by F. L. Haushalter, Development Engineer B. F. Goodrich Co., Akron, Ohio

There has not been a great deal of research work done in connection with the rubber used on punch presses, but a considerable amount of rubber of a firm texture, similar to that used for a tire tread, is being supplied for use in dies of various types for ejecting the stamping after the punching operation. Rubber has also been supplied in one instance to a manufacturer of metal tire-covers for actually forming the metal part against an outer steel form. These rubber dies, as they may be called, held up very well for a great number of covers. The rubber recommended for use in connection with such work is a high-grade tough rubber with a fairly low permanent set.

The question of the compressibility of rubber is frequently raised in connection with power press work. It should be mentioned that there is no reduction in volume of a soft vulcanized rubber; there is only displacement of volume under load, and if there is no place for the rubber to flow, it cannot be compressed. The loading curve of rubber in compression is not a straight line, chiefly because whatever distortion there is must come at the edges of the piece, unless there are holes punched in the rubber sheet or pad to allow for the flow of the rubber into the holes.

On rubber slabs designed for press work or for forming operations, the pressure used may be as high as 1000 pounds per square inch if the rubber is confined sufficiently so that the deflection in the rubber is not more than 20 to 25 per cent of its thickness. However, when the load is applied to the rubber, say, one hundred times a minute or more, the deflection in the rubber may have to be limited to an even lower value, depending on the type of rubber used. Repeated flexing of the rubber at any appreciable frequency creates a great deal of internal stress, which might result in the premature failure of the rubber. Heat-resisting rubber stock has been developed to withstand repeated flexing, and it is usually necessary to consider the actual working conditions of a job in order to recommend the right kind of rubber.

Maintaining Uniform Temperature in Oil Quenching Bath

O. E.—In using a continuous oil quenching system of what seems to be ample capacity, it has been noted that during the course of the day the temperature of the bath gradually rises and that the hardness of the quenched tools becomes less. What should be done to insure uniform hardness at all times?

Answered by the Editor of "Oil-Ways," Published by the Standard Oil Co. of New Jersey

Apparently, even with your ample capacity of oil in the quenching bath, you are not provided with sufficient radiation capacity from the tank to release as much heat as is absorbed during quenching over an extended period of operation. We suggest that the situation can readily be corrected by the installation of brine or cooling water coils directly in the quenching bath or immediately in contact with the outer surface of the bath.

* * *

The country has had ample opportunity to learn that a do-nothing policy is fatal, and that efforts to control and direct natural economic forces whose nature is not understood are useless. The study of statistics, thinking them to be economics, will never lead to an understanding of these forces nor of ethics in human relationship, which, after all, is all there really is to economics.—*Commerce and Finance*

Cast Versus Welded Structures

IN a paper read before the annual meeting of the American Society of Mechanical Engineers in New York, Sol Einstein, chief engineer of the Cincinnati Milling Machine Co., reviewed the rapid development in the use of welded-steel frames in place of castings for many purposes. He referred to the designing problems that have been introduced by this development, and pointed to many of the advantages that the welded structures afford, such as quick delivery, saving of time in making patterns, and reduction in weight of structures. He also analyzed the cost of welded and cast structures under different conditions.

A few welded structures having special advantages over castings were shown. Fig. 1 is one of these. This is a large spider fixture used for profile-milling the corners of door hinges for automobiles. The frame of the fixture is made from a welded structure, while the spider itself is made from a forging 30 inches in diameter and 8 inches wide. Two of these forgings were welded together. The spider was shaped by cutting out pieces from the forging with a torch. Since this fixture was entirely special in design and not likely to be duplicated, at least not on a quantity basis, the welded structure was used to obtain the advantages of quick delivery, strength, and moderate cost.

Fig. 2 shows a small planer type milling machine in which the uprights and the rail with its spindle carriers are standard equipment, while the bed is made from welded-steel plates. This bed had to be made wider than the standard bed for this type of machine, and of greater length. The cost of a pattern for a single casting would have been altogether too great, and, therefore, a welded structure was used. It should be noted that the welded bed is quite similar to a cast bed. It is evident that a welded structure can be made as neat in appearance as a casting if the proper care is taken in the design and construction.

* * *

The use of dry ice has increased by leaps and bounds in the last few years. In 1928, we are informed, the production was 12,000,000 pounds. This year, it will reach about 140,000,000 pounds. The application of dry ice in machine shop operations has been referred to in several articles in MACHINERY in the past.

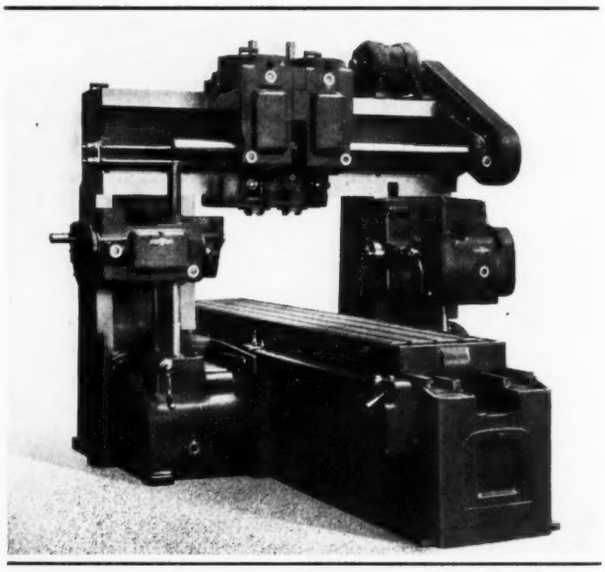


Fig. 2. (Above) A Cincinnati Planer Type Milling Machine with a Special Bed Most Conveniently Made by Welding

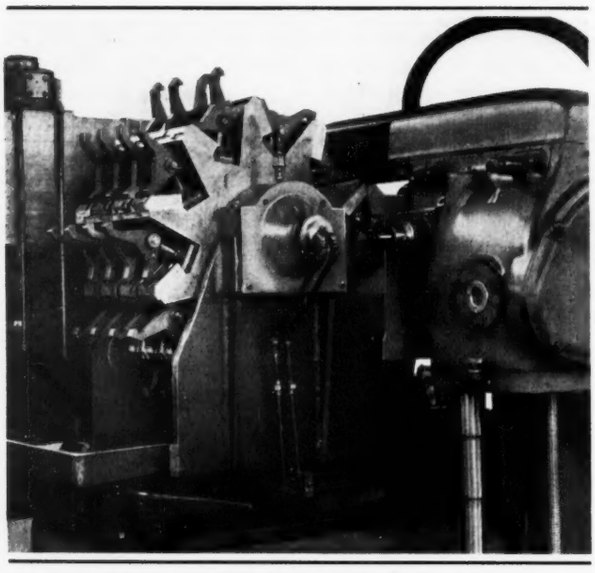


Fig. 1. (Below) Spider Fixture More Quickly and Less Expensively Made from Welded Steel than from a Casting

Gear Manufacturers' Convention

THE nineteenth annual meeting of the American Gear Manufacturers' Association, held at Wilkinsburg, Pa., May 14 and 15, was marked by the presentation of exceptionally valuable reports and papers dealing with important gear developments and problems relating to various branches of the gear industry. The A.G.M.A. believes in establishing and standardizing, as far as possible, designing and manufacturing practice that is based upon the combined experiences of gear specialists in every branch of the industry. While this job is never completed, because of new developments and also because research is constantly revealing unexplored gear territory, nevertheless the A.G.M.A. has made, and will continue to make, great progress in establishing practices for the common good of the industry.

In a paper on "Inspection Methods that Give a New Conception of Gear Accuracy," by S. O. Bjornberg of the Illinois Tool Works, the great importance of correct inspection was emphasized. This paper includes the checking of tooth curves and the normal pitch along the line of action to indicate combined spacing and involute errors.

Another excellent paper, "Methods for Checking Gears," was presented by D. T. Hamilton, Fellows Gear Shaper Co., in collaboration with Robert Beardsley, Jones & Lamson Machine Co. Stress was laid on the great importance of checking the *combined* effect of all errors. The effect of different kinds of errors was demonstrated by projecting the profiles of meshing gear teeth upon a screen.

A paper on "Rotary Crossed Axes Shaving of Spur and Helical Gears" was presented by R. S. Drummond of the National Broach & Machine Co. In crossed axes shaving, the work gear is rotated under only slight pressure with a special cutter in the form of a gashed helical gear of small helix angle. The faces of the cutter teeth have small parallel gashes, and as gear and cutter rotate, there is a reciprocating action. Fine hair-like chips are removed and smooth accurate teeth produced.

Professor Earle Buckingham of the Massachusetts Institute of Technology, presented a discussion of "Proposed British Standard Specifications for Worm-Gearing." The various features of the proposed British specifications were analyzed in detail. The author reached the conclusion that while some details of the design could be improved materially, it would be difficult to improve upon the scope of these specifications.

A. A. Ross, New President of the American Gear Manufacturers' Association

In a "Report on Herringbone Gears," by Frank A. Mickle, Associate Professor of Mechanical Engineering, University of Michigan, it was pointed out that the present A.G.M.A. Recommended Practice for designing herringbone gears evidently is as nearly correct as can be determined until we can prove conclusively in which plane the shape of the tooth is a true involute, and then determine a practical method of ascertaining the shape in the other (normal or rotation) plane.

J. C. McQuiston, manager-secretary of the A.G.M.A., presented a comprehensive paper on "Trends," as related to population, education and training, international trade, increase of obsolete equipment, the radio and the automobile.

John Christensen of the Cincinnati Gear Co. was succeeded as president by A. A. Ross of the General Electric Co., Lynn, Mass. E. S. Sawtelle, vice-president and general manager of the Tool Steel Gear & Pinion Co., Cincinnati, was elected vice-president, and J. H. Jackson, sales manager, Pittsburgh Gear & Machine Co., was re-elected treasurer. J. C. McQuiston continues as manager-secretary.

A. A. Ross, on graduation from Pictou Academy in Nova Scotia in 1894, entered the employ of the General Electric Co. as a machinist apprentice. After completing a mechanical engineering course in night school in 1897, he joined the railway engineering force and was associated with the late W. B. Potter in the development of the present-day, popular, long-life transportation gearing. When the United States entered the war and rushed into service a fleet of ships propelled by steam-turbine driven reduction gears—then a comparatively new type of drive—Mr. Ross was assigned to the Port of New York to investigate and overcome the cause for rapid wear and failures on the gears of the ships being operated by the Emergency Fleet Corporation. After successfully completing this assignment, he was placed in charge of design of high-speed and heavy-duty turbine reduction gears. In 1923, when the General Electric Co. consolidated the manufacturing of all types of gearing at the Lynn plant, Mr. Ross was placed in charge of these departments.

The Only Road to National Recovery

An Inquiry into the Relations between Agriculture and Industry, Prices and Wages, Government Expenditures and Income, and Recovery and Reform—An Abstract of an Address before the Metropolitan Section of the American Society of Mechanical Engineers

By RALPH E. FLANDERS

President, Jones & Lamson Machine Co., Springfield, Vt. and President, American Society of Mechanical Engineers

TWO years of the New Deal have passed into History. Two more years lie ahead of us. It is time to take stock of its achievements and failures. Has it been so successful that its continuance and development are desirable? Is its failure so manifest that the arousing of political opposition becomes a public duty? Or does the appraisal indicate neither unquestioned success nor utter failure, but that result more usually found in human affairs—a mixture of achievement and error, of hopes a little realized and much deferred?

A rapid survey reveals many items of progress. The prices of agricultural products have been raised, and the farmer has become a more active customer for the products of industry. Employment has increased above the low point, and wages have been raised throughout the whole extent of industry. The volume of production has grown. All the business indices have advanced. The number and seriousness of business failures have decreased notably.

But—agricultural recovery was induced by means that are generating serious reactions, and those means cannot safely be applied for another two years. Wage rate increases are being eaten up by a rising cost of living. The decrease in failures is a natural unmanaged result of survival of the strong and fit through a period of stress, and also indicates some measure of governmental credit extended to the remaining weaklings. The business indices have flattened out in the last year, and show some obstinacy about approaching the very moderate levels of 1931.

Most ominous of all, the improvement in employment took place almost entirely in the first six months of the New Deal. There has been little progress since. Particularly is it true that the greatest body of unemployment—that in the building trades and construction industries—remains unimproved and immovable. That sullen total of eight to ten millions of unemployed faces us week after week, month after month, year after year.

All that can be done by blind courage and by ingenious and novel economic political expedient has been done. If the President, if his administration, if the New Deal are to go down in History as having found effective solutions to problems that are momentous, a new attitude, a new approach, must be added to those already applied. The policies of novelty, ingenuity, and improvization must be reinforced by qualities drawn from experience and common sense. I humbly venture to suggest some of these needed elements of experience and common sense.

The True Relation between Agriculture and Industry Must be Understood

The fall in value of farm products was one of the principal phenomena of the depression; and, by inference, it was considered to be one of the principal causes. Three measures were taken to raise the prices of farm products: Devaluation of the currency; marketing agreements; and decreased production subsidized by government grants, in part from processing taxes.

Of these measures, the monetary one was expected to raise the general price level. This it did to a slight degree only, except in the case of commodities whose price is set by world markets. As might have been expected, our devaluation has been met by progressive devaluation by our principal competitors in world markets. Devaluation is a game that all the world can play at; its advantages are short-lived.

The crop control, live stock destruction, marketing agreements, and processing taxes have been more successful so far as concerns the immediate purpose of raising the prices of farm products. They have been less successful in secondary results, which might have been foreseen—which were, in fact, foreseen by intelligent, unemotional observers.

One of the undesirable effects is the loss of a large part of the foreign market for many of our farm products, cotton being the most seriously affected. Was there any excuse for ignoring the recent experience of Brazil in her attempt to control the coffee supply and enhance its price? Why should it not be expected that new cotton areas would be developed and stimulated, as new coffee plantations were? Why was not the limitless ingenuity of the New Deal applied to the problem of maintaining domestic prices *without* destroying

foreign markets—a problem by no means insoluble?

The maintenance of a higher domestic price means that the industrial worker is taxed to raise the farmer's income. This is only excusable on the assumption that the industrial worker is better off than the farmer. Sad as the lot of the latter has been, it would be hard to prove that he has been as helpless, as incapable of self-support, except where drought has been involved, as the city dweller has been in the last five years.

There is something more than injustice involved here. It is a matter more of impossibility than of injustice. These high prices cannot much longer be borne. Already the processing tax on top of the price of cotton is destroying the market for domestic cotton cloth. Mills are shutting down, workers are laid off, and cotton accumulates. Here is one of the tangible elements in our unsolved problems of the unemployed. Policies like this add to their numbers instead of diminishing them. The way to farm prosperity has not yet been found.

It is Industrial Activity that Creates Farm Prosperity

What we seek is a solution that does not tax the worker to support the farmer or burden agriculture to maintain industry. What we seek is a solution that benefits both. The first requirement is a new balance between agriculture and industry, based on the relative demand for the products of the two occupations. There is an insatiable appetite, an unfilled demand of enormous proportions, for the products of industry. There is a corresponding possibility of expanding demand for agricultural materials which go into manufactured goods. But for foodstuffs, which constitute the main product of agriculture, the demand, while capable of further expansion, is ultimately limited by the normal human appetite. As a consequence, a return to our old success in raising the general standard of living will involve an increase of industry relative to agriculture—a resumption of the normal migration from farm to factory rather than a continuance of the present unhealthy reverse movement. In the revival of industry and a consequent drain on the agricultural population lies the hope for a natural, effective balance. If agricultural output ought to be limited, this is the way to do it. We must not permit our temporary dosing with stimulants to interfere with out ultimate recovery, as is now the case.

Even for the short-range solution, agriculture depends on industry. Return to a normal standard of living will expand markets to a point where moderate prices and greater volume will give a larger net farm income than the present artificial conditions can provide. This is particularly true for dairy products.

If industry depends on agriculture, as was the original New Deal thesis, so does agriculture depend on industry, as hard experience teaches. The two are indissolubly bound together. Neither can prosper at the expense of the other. There is a way for them to prosper together from this time on without perpetuating the temporary and dangerous stimulants now being applied. This is by way of a determined reduction in the price of manufactured goods, which will at once stimulate employment and reduce the cost of what the farmer buys, thus raising his standard of living.

We Have Built up a Fallacious Conception of Prices and Wages

Many harmful practices have become intrenched in code making and administration, and in other activities of the NRA as well. There was, on the part of industry, organized labor, and the Administration, from the first beginnings of the original act, an idea that recovery, re-employment, and a raised standard of living would result from a carefully balanced increase in prices and wages. That idea was fallacious and has delayed recovery.

There is no man, or group of men, having the infinite intelligence and widespread power required so to manipulate a rise in wages and prices as to produce a recovery. In all past times, recovery has come when lowered prices stimulated consumption, and the reappearance of profits stimulated expansion and re-employment. The rise of wages and prices has come as a natural result of recovery, not as an impossible cause.

The higher standard of living we are looking for is one that is higher even than that of 1929, which was pitifully low as an average for the mass of the population. A rise in the standard of living means that prices and wages move relatively in *opposite* directions—not together; and in the face of foreign competition and of the remaining disparity between agricultural income and prices of manufactured goods, our choice—if we have a choice—will be for prices to move down rather than for wages to go up. This is the direction that lowers rather than raises tariff walls. This is the direction that stimulates sales and employment. We are suffering from the inherent difficulty of trying to expand business with a price level raised in advance of demand and recovery, rather than because of demand and recovery.

The Fundamental Fact: Lower Prices Help the Wage Earner as Much as Higher Wages

The lowering of prices is as good for the wage earner as a rise in wages. It is better, for it makes more work. A rise in wages tends to raise prices and make less work, if work is already scarce. The classic example is to be found in the case of the building trades, who have been the most successful of all trades in perfecting union organization, with consequent shortening of hours and raising of wage rates. The building trades unions have been so

successful in this that their members remain out of work when others are employed!

While the worker has shown lack of comprehension in maintaining wage rates to his own hurt, he has been matched in this by the industrialist. Business as a whole, being on too narrow a profit margin, has had to raise prices with wage raises. It would like to raise prices further so as to insure itself a safe profit which would warrant extension of business and increased employment; but the raised prices slow up sales, and profit and employment are alike jeopardized thereby. The industrialist is impaled on a dilemma, and a drop in prices seems the most unlikely way of escape that can be imagined. Again, the most outstanding example lies in the building and construction industries. Under the influences mentioned, the manufacturer of materials has duplicated trade union psychology and has maintained prices to his own hurt—for, as we shall see, there is an escape from the dilemma. As it is, labor and industry together are throttling recovery and perpetuating unemployment in this largest remaining sector of unemployment—and the Government is giving its blessing to the process.

To summarize, present prices do not, on the one hand, give the desired standard of living to the worker, nor, on the other, do they furnish a broad enough market or a sufficient profit to the employer to expand operations and employment. Raising prices without raising wages is not feasible, since it still further diminishes sales for the employer and lowers the standard of living for the worker. Improving the standard of living by raising wages without raising prices is impossible in view of present narrow profit margins. Improving profit by lowering wages without lowering prices is so evidently impossible that it is unnecessary to consider it.

The Real Answer is Efficient Operation and Improved Machines

The only remaining possibility is to lower prices without lowering wages. This raises the standard of living and will greatly stimulate the demand for goods. But how is it possible to do this in view of the narrowness of the profit margin? One answer is that this narrow margin might be preserved by the larger scale of operations and the consequent economies. This probably applies to some of the companies producing construction materials. To other industries it will seem to be a forlorn hope.

But the real answer to the problem of a simultaneous increased business output, increased profit, increased employment, and a generally raised standard of living is the answer that shallow theorists deride, shortsighted labor leaders combat, and timid industrialists avoid. *The real answer lies in a renewed and continued application of more efficient machinery.* Properly applied, this remedy makes possible the seemingly impossible. It lowers prices without lowering wages. This is the end we must attain. There is no other means within our power for attaining it.

Better machinery and methods has been the answer of the past. This alone has raised the mass of the population above the level of primitive agricultural subsistence. This alone has given millions of workers the bath tub, the radio, and the automobile. This alone will continue to provide these and newer comforts, and to extend them to millions of families now deprived of them. An immediate return to our former faith in improved machinery will make possible a decrease in prices without a decrease in wages, it will raise the standard of living, it will raise the volume of business production, and it will raise profits to the level required to support the industries whose workers are still largely unemployed.

We need have no fear of thus returning to our old confidence in labor-saving machinery. We have never yet on a fifty-hour week produced goods in a great enough profusion to give a decent standard of living to the average worker. The best of modern equipment will have to be built and installed and put to work on an enormous scale if the desired standard of living is to be possible on a forty-hour week. But this return to our former initiative in the installation of new equipment requires a return to our old-time courage and dependence on private enterprise. This return is made difficult by a number of factors, one of which constitutes our third topic.

One Obstacle to Recovery is the Distrust Caused by Present Governmental Expenditures

Could we put ourselves into the state of mind of only three years ago, our present situation would be incredible. Since March, 1933, in little more than two years, our Federal Government has appropriated more money than in its entire history from the signing of the Constitution to the beginning of the World War—including the cost of the War of 1812, the Civil War, and the Spanish-American War.

It is not merely that we are spending enormous sums; there is an incredible aspect to the means by which we are raising them. They are not being raised by the taxation of profits. There are no profits sufficient to support taxation on the grand scale of our expenditures. They are not being borrowed from the savings of the people. The resources of these savings have long since been exhausted. The billions being expended are simple extensions of credit—a bookkeeping process by which, under continuous unremitting pressure of Government and of circumstance, banks are persuaded to take Government paper and in return write down with typewriter or pen and ink certain figures which permit the Government to draw checks for these easy billions.

With this goes another observation. There is a faint suspicion that something is not quite as it should be. The business man hesitates to venture, to expand, to risk his funds or his credit on expanded employment. There is doubt in the air. Funds no longer flow freely into new investment. That there remains a market for Government paper at low rates—on more favorable terms than for private investment—is no contradiction to the fact of uncertainty. Where all is doubtful, where all is uncertain and indistinct, the Government is perhaps the best of all doubtful chances, the least of all prevailing evils. Particularly is that so when the Government has successfully arrogated to itself the power of life and death over private business, and seems not at all averse to using that power to its full strength. What wonder that utility and industrial and railroad bonds continue at a discount, while new private investment and re-employment hesitate and fail to become effective?

Recovery and Reform—Are We on the Right Road?

Reform has been, and is being, somewhat blindly directed against profits; and because this is so, unemployment must continue, and our enormous expenditures for relief must accumulate. Consider that appropriation of $4,880,000,000 for two years of relief—$2,440,000,000 a year. It is the greatest appropriation ever made by any government at any time. Yet it is pitifully inadequate for the needs of our millions of unemployed. What the unemployed need is the normal $12,000,000,000 to $15,000,000,000 of profit and savings flowing into needed new investment each year—not a beggarly governmental dole of $2,440,000,000 a year.

A sum that endangers governmental credit and yet is inadequate could be multiplied *five times* by private industry, if private industry were encouraged to make its normal profit and apply that normal profit to its normal use in maintaining employment in the industries that are now depressed.

Industry, on its part, has its own lessons to learn. There is no profit for industry in following the trade-union theory of restricted output and raised prices. Real profits to industry, to labor, and to agriculture, will come from an extension of labor-saving machinery, combined with lowered prices and increased output.

We need not fear that these profits resulting from the installation of new equipment will themselves interfere with our healthy progress. Business profits—that is, profits from the production and distribution of goods and services—have never been too great for the needs of financing the equipment for our rising standard of living. It is "profits" of another sort that have repeatedly thrown us into business confusion and social disintegration. What we have to fear and control is speculative profits, and particularly the inflated bank credit (that is, unpayable debt) on which such profits are based. Here lies the major problem of business stability.

It is not the *amount* of profits that destroys, but the *kind*. But it is the amount of profits that the Administration has set its face against. If one member of the Administration renders lip-service to the profit system, another attacks it directly or by inference. If irresponsible and undisciplined members of the Administration chance to be silent, powerful legislative interests set about the making of laws that will destroy profits and perpetuate unemployment. And if underlings and legislators alike chance to be silent, the Chief Executive himself gives clear indication that the fight is still on against business profit and consequent re-employment.

The Case of the Utilities is an Illuminating Example

Let me give a specific instance. Again and again, the Administration has attacked the utilities, both as to their corporate structure and their rates. In both respects, the utilities are vulnerable. Their rates are of importance to consumers. They might, in many instances, conceivably be reduced in amounts that would reduce the bill of the average household consumer by sums ranging from $15 to $50 per year. There is, in other words, the same opportunity for increased efficiency, lowered prices, and increased consumption for the utility that there is for other industries.

But the utilities affect the common man in other ways. In the building up of their corporate structures during the boom period, in the emission and sale of pyramided securities, lay the seeds of the boom that ended in 1929 and of the dismal years that followed. Here was a phenomenon that has cost many a family—not $15 to $50 annually—but years of unemployment and a life time of savings. The legislation for controlling that catastrophe is already on the books in the form of the Securities and the Securities Exchange Acts; but the continuous hammering on the minor element of rates, and particularly the way in which it is done, is delaying re-employment.

The TVA "yardstick" is the weapon. It is a weapon—not a yardstick. If the TVA rates indeed constituted a yardstick, calculated, under the public eye, to set a real measure of proper cost of electric current to the public, then private initiative and capital could flow into a field that remains an attractively profitable one, even if "rich pickings" were outlawed. But this is not the case. The governmental yardstick being flourished by emotion instead of being constructed and applied by reason, there is no surety of return for investment in utilities. As a consequence, we have stagnation in a field that should be active. Last December the output of electric current approached the all-time record. Next December it may break that record. Under normal circumstances, there would be in-

creasing activity in power plant construction and thus increasing employment of those now unemployed. But the TVA club is flourished and private initiative and funds seeking investment all run for shelter. The Federal Power Commission plaintively wonders that there is no new construction. The unemployed wonder why they have no work. Not reform, but recovery—that is what the unemployed need most, right now.

Reform, if Necessary—but Let Us Not Overlook the Need of Recovery and Employment

The essentials of reform are nearly complete, and their completion constitutes the valid and unparalleled achievement of the New Deal. These essentials are to be found in the hour and wage provisions of the NRA, which set a subsistence minimum, below which the competition of depression will not be permitted to submerge the worker. They are to be found in the Securities and Exchange Acts, with all their crudities, yet furnish the means for the control of speculative inflation. Only one essential element is still lacking—a banking law that will give to our credit money system a control that is exercised in the public interest—not in the interests of the political needs of a transient administration, on the one hand, nor in the interests of speculative greed, on the other. With this problem solved, we have all the reform we now need and can now assimilate. From this point on, our task is not reform, but recovery and re-employment.

The necessary processes are not difficult, not incomprehensible, not arduous. As they have been outlined in the preceding paragraphs, they are seen to consist of old and useful practices to be returned to, rather than of novel expedients to be rapidly experimented with, discarded, and thrown aside. The direction is straight forward along the path we have been following for generations. If industry, if labor, if finance, if Government—above all Government—get a clear picture of that course and bend their efforts to following it, the American people will continue that old course, but with fewer interruptions, toward more continuous employment, higher material standards of living, and new spiritual experiences.

International Business Machines Corporation Air-Conditions Large Machine Shop

One of the most unique air-conditioning systems ever installed is that found in the machine shop of the International Business Machines Corporation at Endicott, N. Y. It is unique because, as far as is known, it is the only machine shop in the country that is completely air-conditioned wholly for the comfort of the employes. The installation was made in 1934 on the initiative of Thomas J. Watson, president of the corporation, whose efforts toward better working conditions are well known.

The shop is air-conditioned by the use of twenty-nine units, eight of which are fresh-air units; the others circulate the air in the shop, filter it, humidify it, and heat or cool it as required. Both the heating and cooling of the air are accomplished by the use of the exhaust steam from the engines in the boiler house.

In the summer time, the air is cooled by the exhaust steam, which is obtained at two pounds pressure. The steam is condensed by mixing it with about 800 gallons of water per minute, and this condensation of steam creates a vacuum which becomes instrumental in cooling the water that is circulated through the units. Owing to the large quantity of water required, it was necessary for the company to procure its own wells.

After the system had been in operation for some time, an analysis was made of the dirt taken from the filters which recirculate the air in the machine shop. It was found that this dirt contained 18 per cent oil, 72 per cent iron dust, and 10 per cent of other materials. An analysis was also made of the dirt on the filters of the fresh-air units. It was found that this contained 77 per cent coal dust and soot, and 23 per cent cinders, sand, and grit. It is estimated that about half a ton of dirt will be removed from the air of the shop each year.

Another interesting fact that should be recorded is that, by comparing a two-weeks period before the system was placed in operation with a two-weeks period after the system was started, it was found that the treatments for colds decreased over 50 per cent in the machine shop, relative to the number of treatments in other departments that were not air-conditioned.

The system was designed and installed by John M. Demarest, plant engineer of the corporation, working in conjunction with the Niagara Blower Co. It has been so laid out that the capacity of the system can be easily doubled.

* * *

There is too much thought given to limiting production. Why not give some attention to a real worthwhile increase in consumption, a genuine increase in the standard of living? Then production would take care of itself.

Getting Results from Haynes Stellite

By J. C. HUSTON
Haynes Stellite Co., Kokomo, Ind.

MUCH interest is being displayed at the present time in the different cutting-tool materials. The increasing activity in metal-working shops is partly responsible for this. Other contributory factors are the keen competition and close cost margins, necessitating the most economical methods of machining. Some of the results obtained with Haynes Stellite cutting tools by one of the foremost manufacturers of printing presses will, therefore, doubtless prove of interest to those responsible or results in machine shop operations.

One of the jobs was the cast-iron printing press roll shown being turned in Fig. 1. This roll was rough-turned all over and the ends rough-faced. The large diameter of the roll was 15 inches, and the length of that part of the roll 45 1/2 inches. For about 40 inches of the length, there was a 5/8-inch slot or groove in the roll, running parallel to the center line, making the cut intermittent in character.

For rough-turning the large diameter, the roll was run at 94 surface feet per minute. The feed was 1 3/4 inches per minute, or about 0.073 inch per revolution. The depth of the cut averaged 3/8 inch, but the roll was slightly eccentric, making the cut 1/4 inch deep on one side and 1/2 inch on the other side. The tool was of the double-end type, 1 inch by 2 inches by 14 inches, tipped with Haynes Stellite.

The end of the roll, as shown in Fig. 2, has six spokes. For the facing operation, the roll was run at 36 revolutions per minute, the feed was 0.038 inch per revolution, and the depth of cut varied from 1/4 to 1/2 inch. The tool was similar to the one used for turning. It is obvious that, due to the spokes, the tool gets a great many hammer blows during this facing operation; yet it stood up well.

The type of Stellite known as J-Metal was used, and for the purposes outlined, was deemed by this manufacturer the most efficient cutting tool. In spite of the excellent condition of the heavy-duty machines, vibration was present, due to the character of the parts machined; in addition, several of the cuts were intermittent. These difficulties were overcome by the use of specially built tool-posts that were made sufficiently strong and rugged to withstand the force of the cut and hold the tools securely.

Another job performed at this plant is the machining of a cast semi-steel gear blank (Fig. 3)—roughing the outside, rough-facing, and rough-boring. The tool used for rough-turning and rough-facing is a 1- by 1 3/4- by 8-inch J-Metal tipped tool. The boring tool is a 5/8-inch square J-Metal bit. The casting is run at 109 surface feet per minute for the cut on the outside, with a feed of 1/32 inch per revolution, and a depth of cut varying from 1/8 to 3/16 inch. The depth of cut and the feed are approximately the same for the rough-facing and boring. These examples indicate what, at the present time, is considered good practice in the use of Stellite cutting tools, and may prove of some guidance to others.

Fig. 1. Rough-turning a Printing Press Roll, Using Stellite Tools

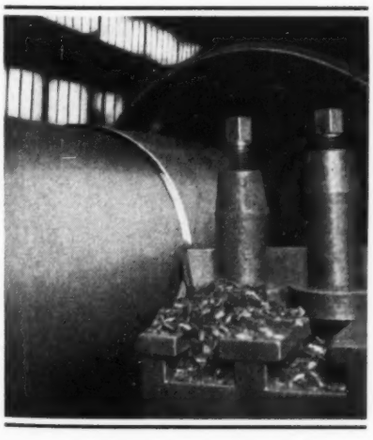


Fig. 2. Turning Journals and Facing End of Roll. Note Intermittent Facing Cut

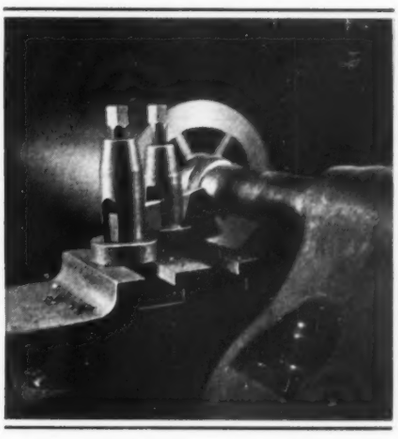
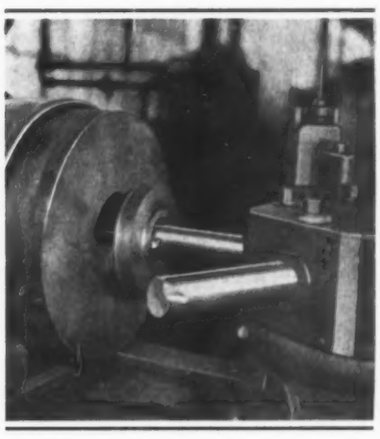
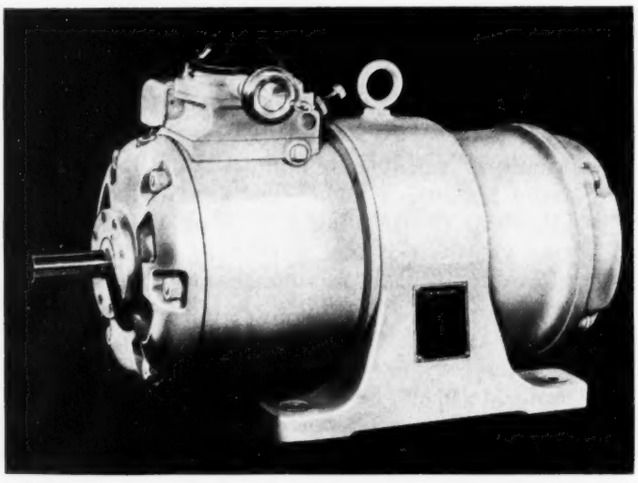


Fig. 3. Machining Cast Semi-steel Gear Blanks at 109 Surface Feet per Minute



The "Transitorq"—A New Gearless Variable-Speed Transmission



An Infinite Number of Speeds are Obtainable through a Unit Driven by an Integral Constant-Speed Motor

HARDENED steel rollers held under pressure in contact with hardened steel races are employed in a motor-driven transmission unit known as the "Transitorq," which has been developed by the New Departure Mfg. Co., Bristol, Conn., to give any desired speed between the maximum and minimum. For example, when the unit is driven by a motor running at 1750 revolutions per minute, any speed from 600 to 3600 revolutions per minute, or from 560 to 5600 revolutions per minute, depending on the size of the unit, can be instantly obtained. With motors running at 1200 or 900 revolutions per minute, correspondingly slower speeds are provided.

The drive from the constant-speed input race *A*, Fig. 2, to the variable-speed output race *B* is transmitted through three rollers mounted in a stationary spider *C* (see also Fig. 1). Each of these rollers is free to revolve on a ball bearing. In addition, any roller can be inclined a limited amount, as indicated by the dot-and-dash lines in Fig. 3. By changing the inclination of the rollers, any desired speed can be obtained. With the rollers positioned as in Fig. 3, the output shaft of the unit is driven at the same speed as the armature shaft of the motor.

The output speed is controlled through the mechanism mounted on top of the unit, as seen in the heading illustration. This mechanism includes an indicator dial supported on a circular housing,

Fig. 1. Method of Mounting the Three Rollers which Contact with Toroidal or Dish-shaped Races to Give Desired Speeds

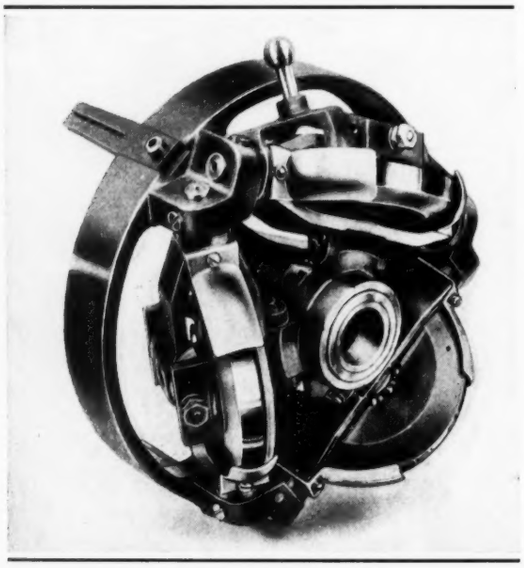
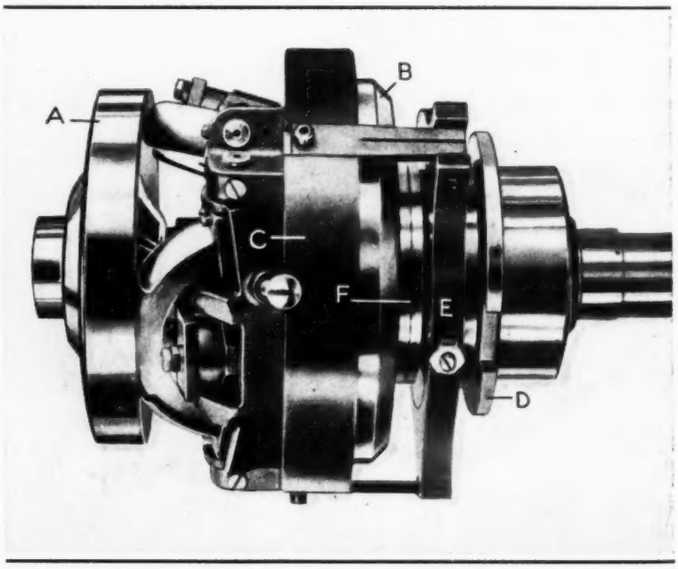


Fig. 2. Unit that Gives Infinite Number of Speeds and also Automatically Controls Pressure between Rollers and Races



which can be rotated by a small handwheel or by remote control to obtain any desired speed. Within the housing, and connected to a vertical shaft that operates the roller shifting mechanism, is a rotor or vane. When the power unit is started, oil delivered under pressure by a pump enters the housing behind the vane and revolves it against spring pressure until it reaches a stop. The position of this stop depends upon the output speed for which the indicator dial has been set.

When the unit is running, the vane is kept in contact with the stop hydraulically. By turning the handwheel, the circular housing and the vane can be rotated as one, to increase or decrease the output speed. When the unit is stopped, the oil pressure is immediately relieved, and the vane automatically returns under spring pressure to its low-speed starting position.

The advantages of this control are: It permits the unit to be adjusted for any speed, either before or after starting; it permits the unit to return automatically to the low-speed, high-torque starting position whenever the power is switched off; and it allows the unit to shift automatically from low speed to any pre-selected speed. The time required to change from low speed to any pre-selected speed may be varied by an adjustable valve on the speed control mechanism. With this valve fully opened, the unit will accelerate from the lowest to the highest speed or decelerate from the highest to the lowest speed in three seconds.

In designing this unit, it was realized that the traction between the rollers and the races would not be interrupted so long as the pressure between them was proportional to the torque load or tangential force. The imposed torque load itself has been utilized by means of an automatic device to generate the required pressure. This device is so sensitive to the slightest change in the imposed torque that the roller contact pressure is positively maintained under either continuous, variable, or shock loads in a definite proportion to the load, so that a positive drive is obtained under all conditions.

The pressure regulating parts consist of stationary and floating torque-loading flanges *D* and *E*, Figs. 2 and 5, separated by three balls equally spaced in grooves in the flanges. The depth of these grooves varies, so that with a slight rotary movement of the floating flange, there is also a definite axial movement of the flange. This movement is communicated through the angular-contact ball thrust bearing *F* to the variable-speed output race *B*.

Since this race is located axially only by the ball thrust bearing on one side and the rollers on the other, the thrust imposed by bearing *F* controls the contact pressure between the races and the rollers. The traction or driving forces between the input and output races and the rollers act in the same direction and tend to rotate the spider that carries the rollers. This tendency toward rotation is imparted to the floating flange by three fingers. Consequently any change in the imposed torque,

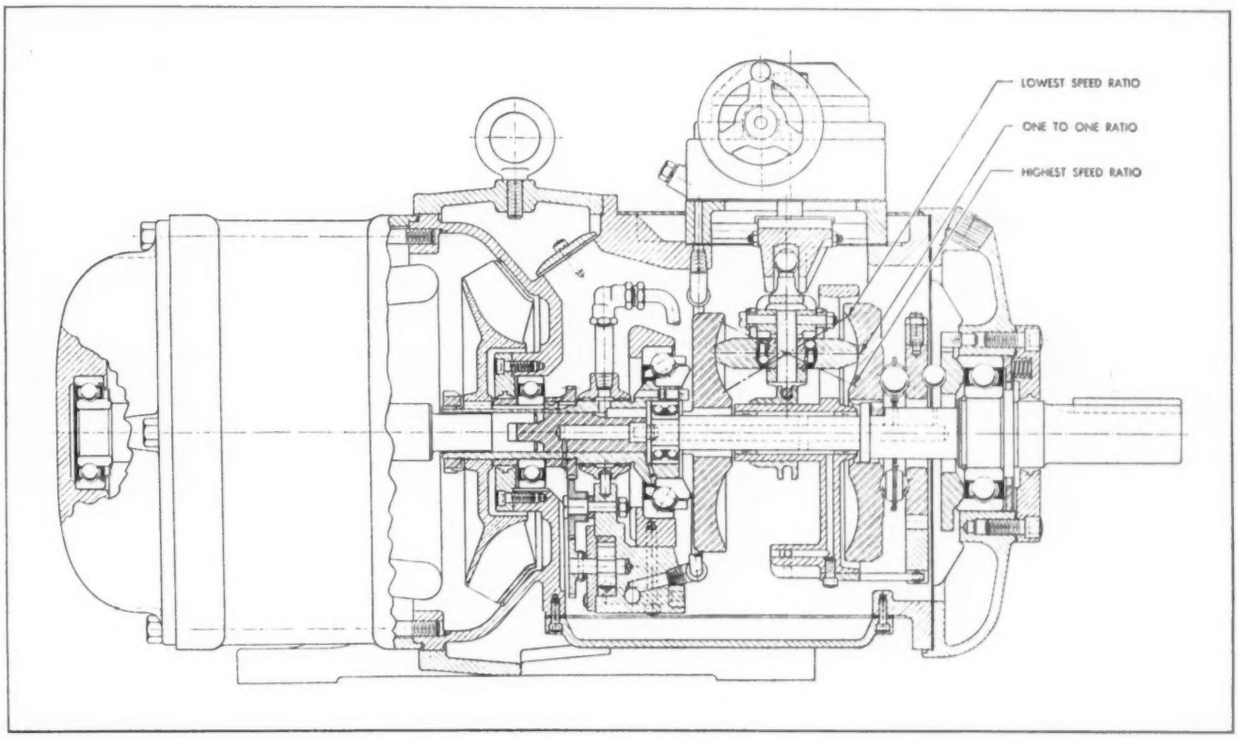


Fig. 3. Sectional View of the New Departure Variable-speed Power Unit

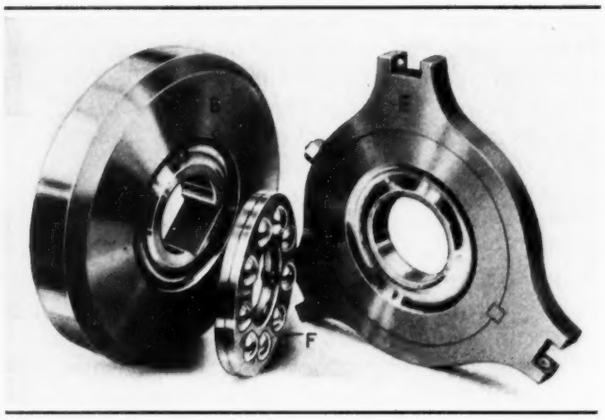


Fig. 4. The Variable-speed Output Race B, Angular-contact Thrust Bearing F, and Floating Torque-loading Flange E

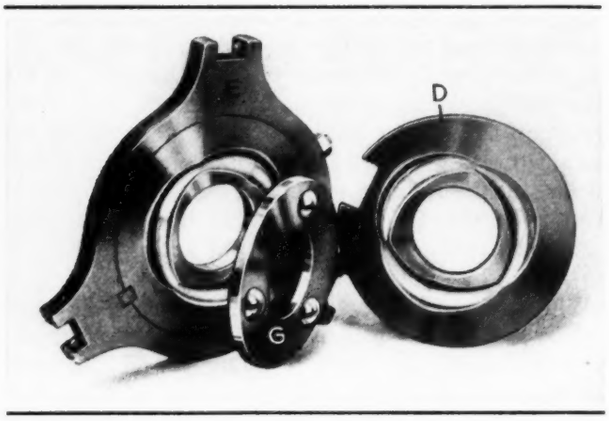


Fig. 5. Floating Torque-loading Flange E, Torque-loading Ball Retainer G, and Stationary Torque-loading Flange D

whether due to a sudden shock load or simply to a gradual load increase, results in a change in the roller traction, a corresponding partial rotation of the torque flange, and a definite change in the roller contact pressure.

This power unit and speed control mechanism can be supplied to suit a variety of mounting conditions. The leg casting can be completely removed in order to build the unit into a machine, or it can be swiveled to permit mounting the unit on the floor, wall, or ceiling. The speed control mechanism can be positioned at various angles in the horizontal plane.

When the power unit is mounted beyond easy reach of the operator, but at some point on or close to the driven machine, the handwheel of the speed control mechanism is removed and a flexible shaft used to connect the unit with a dial and handwheel mounted on the driven machine within convenient reach of the operator.

This method is applicable to many types of machines. Fig. 6 shows the power unit mounted under the bed of a lathe with the start-stop switch and the speed control dial located in front of the headstock.

When speed changes occur in irregularly timed cycles, a cam of proper contour can be provided for operating the speed control mechanism. Also a remote control can be supplied in cases where an operator has to run one or more machines from a considerable distance.

This power unit is made in various ratings from 1/4 to 20 horsepower with speed ratios up to 10 to 1, depending upon the size. The different sizes of power units are furnished with either the horsepower or the torque constant over the full speed range.

* * *

Lubrication of Die-Casting Machines

Colloidal graphite is recommended by the Acheson Oildag Co. for the bearings and sliding surfaces on die-casting machines. When applied to the push-pins, it is especially effective in preventing sticking. A coating of graphite, formed with colloidal-graphited water, when applied to new dies, lengthens their life, reduces the number of "throwouts," and improves considerably the quality of the finish on the castings. Old dies that have become checked may be continued in use by treating their surfaces with concentrated colloidal-graphited water, and then buffing, upon drying, the resulting graphite film.

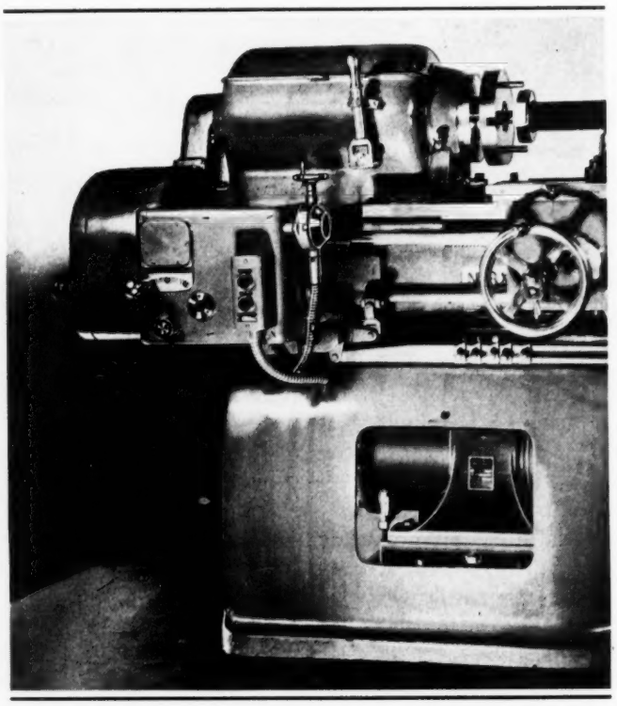


Fig. 6. Typical Method of Installing the New Departure Variable-speed Power Unit and its Speed Control on an Engine Lathe

Massachusetts Tech Offers New Cooperative Course in Mechanical Engineering

A new five-year cooperative course in mechanical engineering is being opened this month at the Massachusetts Institute of Technology, Cambridge, Mass. The new course, which is designed to give students an insight into the technical and executive aspects of industrial manufacture, will be given in cooperation with the General Electric Co. Under the cooperative plan, which is similar to that successfully operated for several years by the department of electrical engineering, students will carry on practical work in the company's plants in conjunction with their studies at the Institute.

The industrial work has been carefully planned with a view to its educational value, and at all times will be closely correlated with instruction at the Institute. The content of the first four years of the course will be essentially the same as that given in the present course in mechanical engineering, there being no omissions in the fundamental and professional subjects. Those subjects omitted from the regular course curriculum have their counterparts in the program at the works. The final year of graduate study and research will be planned for each student in accordance with the requirements of the graduate school. During the final term students may be assigned to the company's research departments for special work designed to develop individual aptitudes.

Students will be chosen for the new option on the basis of aptitude and scholastic records after two years' study in the regular mechanical engineering course. The subsequent three years, including summers, will be spent either at the Institute or at the industrial plants. The course will lead to the degree of master of science, together with the degree of bachelor of science as of the preceding year.

Exports of Industrial Machinery are Steadily Increasing

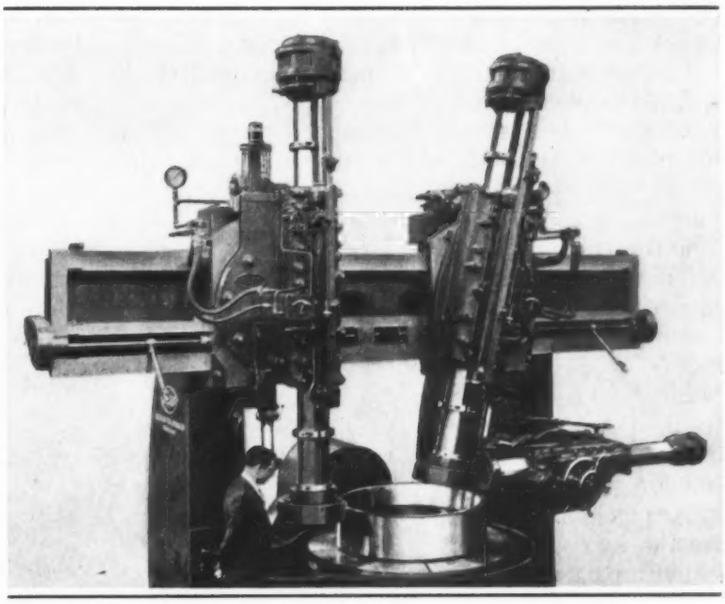
The steady increase in exports of industrial machinery from the United States is one of the most encouraging signs of world business recovery. After a continuous decline from a peak of over $275,000,000 in 1929 to $55,000,000 in 1933, exports of $98,349,000 in 1934 were encouraging. Present indications are, according to the Bureau of Foreign and Domestic Commerce, that a further increased trade will be evident in 1935.

The export gain in 1934 over 1933 was 78 per cent. The countries that were the leading customers of the United States for industrial machinery in 1934 in the order of their importance, together with the approximate value of the exports of machinery to those countries, are as follows: Canada, $15,000,000; United Kingdom, $11,775,000; Mexico, $7,590,000; France, $7,065,000; Japan, $5,155,000; Venezuela, $4,075,000; Russia, $3,880,000; Argentina, $3,490,000; South Africa, $3,290,000.

* * *

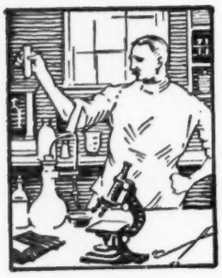
Welded Safety Equipment

In the publication *Oxy-Acetylene Tips*, the point was stressed that a great deal of the safety equipment for various uses around a manufacturing plant can be fabricated at small cost right in the plant by the company's own men. This is especially true if the plant has a well equipped welding shop or a mechanic who has been trained in welding. With comparative ease, such equipment as safety guards can then be made in short time and at small expense. The material used can often be salvaged from scrapped parts at a saving that is only fully appreciated when a similar article is purchased in the market in finished form.



A huge precision grinding machine that stands 18 feet 6 inches above the floor level and weighs over 50 tons grinds the cups and cones used in large Timken bearings. Parts up to 65 inches outside diameter and 36 inches high can be handled. Three surfaces can be ground with one setting. The two vertical grinding spindles are about 12 feet long and are driven by 25-horsepower motors, while the horizontal spindle is driven by a 5-horsepower motor. In a test run, a bearing 47 inches outside diameter, ground on this machine, was found to have a run-out of only 0.00025 inch. The machine is equipped with Timken bearings at all points. It was built by the Niles Tool Works Co.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Republic "Double Strength" Steel for Transportation Equipment

Two important factors contributing to the high cost of railroad transportation are the heavy weight of the equipment, in comparison with the pay load, and its rapid deterioration, due to constant exposure to the elements. With a view to reducing these handicaps, the Republic Steel Corporation, Youngstown, Ohio, has placed on the market, after several years of special research, a copper-nickel-molybdenum steel that possesses the combination of high strength, ductility, and resistance to atmospheric corrosion.

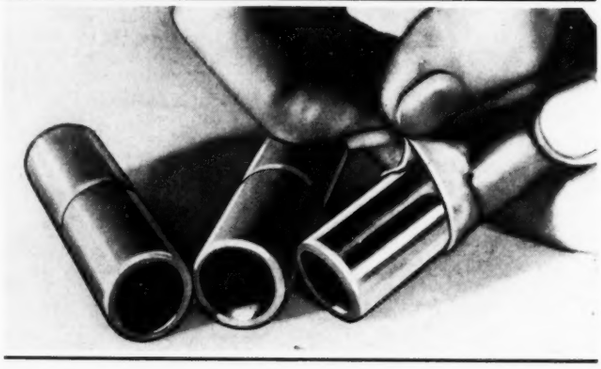
This "Double Strength" steel, as it is termed, is produced in two grades. Both have the same chemical analysis, except for the carbon content which is held to 0.12 per cent maximum in Grade 1 and to 0.30 per cent maximum in Grade 1-A. The remainder of the analysis is as follows: Manganese, 0.50 to 1.00 per cent; copper, 0.50 to 1.50 per cent; nickel, 0.40 to 0.80 per cent; and molybdenum, 0.20 per cent maximum. The copper in the analysis increases the yield point and improves the rust resistance. The nickel combines in the iron with the copper and has an important toughening effect, thus increasing the shock resistance of the steel. The molybdenum has the effect of holding both the copper and nickel in solution in the iron.

An important feature of these structural steels is that the physical properties can be considerably increased by tempering. Normalized sheets, strips, and plates of Grade 1 have a minimum yield point of 60,000 pounds per square inch, a minimum tensile strength of 75,000 pounds per square inch, and a minimum elongation in 2 inches of 25 per cent. Similar products of Grade 1-A have a minimum yield point of 70,000 pounds per square inch, a minimum tensile strength of 90,000 pounds per square inch, and a minimum elongation in 2 inches of 18 per cent. The physical properties of both grades can be increased from 15,000 to 20,000 pounds per square inch by tempering the sheets at from 900 to 1000 degrees F.

"Double Strength" steel has an oxide skin that remains unusually tight under exposure to the most severe atmospheric conditions. For this reason, it is particularly advantageous for use in the construction of railway equipment and automotive trucks engaged in carrying coal and other corrosion-promoting products. Even with its unusual combination of high strength, corrosion resistance, and ductility, this steel can be fabricated without difficulty. It has little tendency to air-harden, and hence it is especially adaptable to welding by the arc method. It can also be satisfactorily spot resistance-welded. Material under No. 16 gage should be spot-welded, as it is too light to be welded satisfactorily by other means, but arc welding is suitable for material as light as No. 16 gage.

Rubber Protective Coating Applied Like Paint

Numerous applications appear feasible for a rubber protective coating developed by Kelsan Products, St. Clair, Mich., which can be applied to metal parts in liquid form by brushing, spraying, or dipping. Within a few minutes after the coating has been applied, it becomes live rubber and will pro-



Removing a Kelsanite Rubber Protective Coating from Automobile Piston-pins

tect the surface from corrosion or dirt, being both waterproof and air-tight. This coating is known as "Kelsanite." It is a non-inflammable liquid containing latex.

The coating has high adhesive qualities, but it does not vulcanize to surfaces on which it is applied. After the coating has served its purpose, it can be easily stripped off, like a Cellophane wrapper. The illustration shows a Kelsanite coating being stripped from a piston-pin.

In the machine-building field, Kelsanite can be employed to protect various parts, or an entire machine, during storage or transportation. Parts that are to be electroplated can be protected by this rubber material at points where the plating is not wanted. Kelsanite can also be used to mask portions of surfaces during painting operations as, for example, in painting automobile bodies.

One automobile manufacturer has experimented with coating entire automobile bodies with the material as they come from the paint shop, so as to protect the bodies during their progress along the final assembly line. Consideration has also been given to leaving the coating on the automobile bodies until just before the cars are actually delivered to the buyers.

Monel Metal with a Hardness up to 350 Brinell

The Bayonne Foundry of the International Nickel Co., Inc., 67 Wall St., New York City, has developed a new material for producing corrosion-resistant castings of unusual hardness. This metal is known as "S Monel." It is somewhat similar in analysis to regular Monel metal, the main difference being in the silicon content, which is raised to a maximum of 3.75 per cent. In addition to being harder than the regular grade of Monel metal, the new material offers greater resistance to wear and erosion, particularly steam erosion. Another important advantage is that it is non-galling, especially at high temperatures.

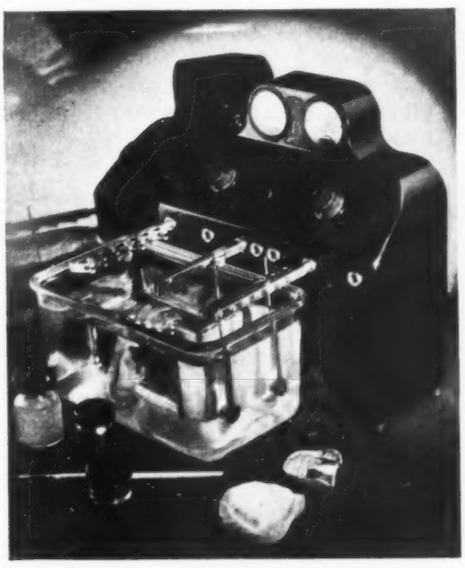
As cast, the material can be machined without difficulty if the hardness is held to 325 Brinell by limiting the silicon content to 3 per cent. Harder grades must be softened for machining and afterward rehardened by heat-treatment. The physical properties of S Monel metal are as follows: Tensile strength, 100,000 to 120,000 pounds per square inch; yield point, 90,000 to 110,000 pounds per square inch; elongation in 2 inches, 2 to 5 per cent; reduction of area, 2 to 5 per cent; and Brinell hardness, 275 to 350.

Another grade of Monel metal that was developed coincidentally with S Monel has an intermediate hardness of from 225 to 250 Brinell. The chief advantage of this metal is a higher ductility than S Monel. However, it does not possess the same anti-galling qualities. The silicon content is approximately 2.50 per cent.

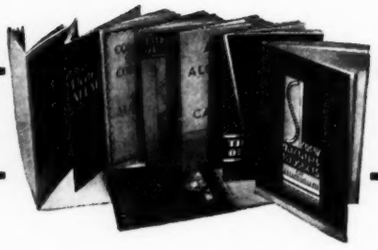
A New Corrosion-Resisting Alloy of High Tensile Strength

The trade name of "Yoloy" has been given to a nickel-copper alloy steel recently developed by the Youngstown Sheet & Tube Co., Youngstown, Ohio. The advantages claimed for this material are an exceptional resistance to corrosion, high tensile strength, high ductility, workability, and weldability. The material is intended for applications where resistance to corrosion is a factor of vital importance, where abrasion must be withstood, and where longer life of a product is desired for the same weight of material or equal life with a lighter weight.

Yoloy steel is produced in sheets, strips, bars, plates, shapes, wire, and seamless pipe to meet fabrication needs.



Synthetic plastics invade the dental equipment field. The apparatus shown is for forming metal denture plates by electrolytic deposition, and is built by the Hanau Engineering Co. The entire cabinet is molded from phenolic plastic material—General Plastics' black Durez—by the Norton Laboratories, Inc. The reasons for the choice of molded plastics are several: The case is too intricate in shape for a single metal stamping and rather too large for a metal die-casting; the molded case forms its own electrical insulation; and the acid used in the electrolytes will not have an injurious effect on the phenolic plastic case.

NEW TRADE  LITERATURE

Comparators

JONES & LAMSON MACHINE CO., Springfield, Vt. Catalogue illustrating and describing in detail three J & L optical projection machines, namely, the pedestal comparator and measuring machine for inspecting the contour of a large variety of tools, gages, and products by the visual method; the bench type comparator for the rapid and accurate inspection of screw threads or other irregular profiles; and the Model C comparator for inspecting large, heavy objects. Instructions are given for inspecting the profile of forming tools; taper threads, and internal threads.

Indicating and Controlling Instruments

LEEDS & NORTHRUP CO., 4900 Stenton Ave., Philadelphia, Pa. Bulletin 4001 on the application of electric thermometers to the regulation of an air conditioning system. Catalogue section NC24A, descriptive of the Leeds & Northrup simplified two-position Micromax controller for regulating the temperature of electric furnaces, kilns, etc., where radiation losses are low and heat is well distributed, or for use on fuel-fired furnaces where fluctuations in furnace pressure and combustion conditions are not too sudden or too great.

Seamless Tubing

SUMMERILL TUBING CO., Bridgeport, Pa. Catalogue containing complete data on the Summerill line of seamless tubing and its many applications. The different products are classified under the following headings: Mechanical tubing; pressure tubing; stainless steel tubing; special alloys; and radio nickel tubing. Besides the catalogue data, the book contains much technical information, including tolerance tables, weight tables, chemical composition, stainless corrosion data, etc., which should be of considerable value to prospective users of seamless tubing.

Microscope Equipment

E. LEITZ, INC., 60 E. 10th St., New York City. Bulletin 17, entitled "What Scientists Say of Leitz Ultropak," containing letters from users of this equipment in various fields of science, describing the results that have been obtained in different applications.

Bulletin 18, descriptive of the Leitz "Ultropak" — microscope equipment by means of which the structural details of all kinds of specimens are disclosed, irrespective of size, shape, or structure, in a manner that is not possible with the conventional microscope.

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Electric Motors

PEERLESS ELECTRIC CO., Warren, Ohio. Catalogue 105, containing data on the Peerless line of electric motors, including single-phase repulsion-start induction-run motors; polyphase squirrel-cage induction motors; split-phase motors; high- and low-torque capacitor motors; direct-current motors and generators; and special motors. The catalogue also includes specifications on Peerless electric grinders, exhaust fans, air-conditioning equipment, and blowers.

"Fibro Forged" Socket Screws

HOLO-KROME SCREW CORPORATION, Bristol, Conn. Loose-leaf catalogue containing complete information on the construction, advantages, and applications of a new type of socket screw known as the "Holo-Krome Fibro-Forged" screw, which is manufactured in such a way as to give the screw a continuous fiber structure, resulting in unusual strength. The data given covers set-screws, cap-screws, stripper bolts, and pipe plugs with different types of threads.

Electric Control Equipment

MONITOR CONTROLLER CO., Baltimore, Md. Catalogue in loose-leaf binder form, containing fifty-six bulletins, twenty-six of which are concerned with direct-current control apparatus, and seventeen with alternating-current apparatus. Among the equipment covered are magnetic controllers, magnetic contactors, and starters of various kinds. Thirteen bulletins deal with accessories, such as push-button stations, limit switches, field rheostats, etc.

Material-Handling Equipment

ELWELL-PARKER ELECTRIC CO., Cleveland, Ohio. Bulletin entitled "This New Industrial Pick-Up," illustrating and describing the pallet system of handling loads, which utilizes low, flat wooden trays or pallets of inexpensive construction in connection with Elwell-Parker power fork trucks. More than fifty actual operating installations are shown in many different branches of industry and transportation.

Lubricants

STANDARD OIL CO. (INDIANA), 910 S. Michigan Ave., Chicago, Ill. Series of pamphlets dealing with industrial lubrication under the following headings: Lubrication in Gear-Cutting Operations; the Lubrication of Diesel Air Compressors; the Lubrication of Mine Locomotives; Diesel Engine Bearing Lubrication; the Lubrication of Beaters and Jordan Engines; and the "Lubrication Engineer."

Portable Drafting Machines

DRAFTO CO., Cochranton, Pa. Circular descriptive of the Drafto portable drawing machine for engineers, architects, salesmen, executives, or others whose work requires the making of drawings or sketches quickly. The circular shows the four standard sizes in which these drafting machines are made, and gives complete specifications, including prices.

Pneumatic Wrenches

INGERSOLL-RAND CO., 11 Broadway, New York City. Bulletin an-

nouncing a new Ingersoll-Rand pneumatic Pott impact wrench, which is made in two types—reversible and non-reversible. The circular shows many different applications of this tool on railroad shop work, shipyard work, oil refinery work, pump assembly, and automobile work.

Welding Electrodes

METAL & THERMIT CORPORATION, 120 Broadway, New York City. Booklet 2, giving brief but complete data on Murex heavy mineral-coated electrodes. Considerable technical data, including principles of design and operation, as well as physical properties and chemical analyses of deposited metals, are given.

Grinding Wheels

NORTON CO., Worcester, Mass. Circular containing information on Norton disk wheels, which are made in solid and segmental vitrified, solid and segmental Bakelite, solid silicate, and solid shellac types. Mounting instructions and a table showing the disks to use for various kinds of surfacing are included.

Roller-Bearing Axles

TIMKEN ROLLER BEARING CO., Canton, Ohio. Catalogue giving the results of research work, including physical tests, on the stresses in railroad axles, undertaken with a view to increasing the life of the axles. The study included a comparison of the Timken type axle and the standard A.R.A. axle.

Centrifugal Pumps and Gas Engines

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin W-318-B6A, descriptive of Worthington two-stage volute centrifugal pumps. Bulletin S-550-B5, illustrating and describing Worthington horizontal two-cycle gas-oil engines.

Photo-Electric Relays

WESTON ELECTRICAL INSTRUMENT CORPORATION, Newark, N. J. Circulars illustrating and describing various forms of photo-electric relays for industrial control purposes in such operations as counting, weighing, smoke-detecting, controlling doors, operation of safety devices, etc.

Portable Electric Tools

BLACK & DECKER MFG. CO., Towson, Md., is distributing a catalogue, in celebration of its Silver Anniversary, showing the complete line of Black & Decker portable electric tools, including electric drills, tappers, screwdrivers, grinders, saws, hammers, sanders and polishers, valve refacers, etc.

Electroplating Equipment

UDYLITE CO., 1651 E. Grand Blvd., Detroit, Mich. Leaflet announcing two recent additions in the field of electroplating equipment, namely, a new Udylite rheostat and a new Udylite plating barrel. The circular also describes the advantages of ball anodes for all plating processes.

Small Tools

NATIONAL TOOL CO., Madison Ave. at W. 112th St., Cleveland, Ohio. Catalogue J, covering the National-Cleveland line of milling cutters, hobs and gear cutters, gear shaper cutters, sprocket wheel cutters, reamers, interchangeable counterbores and spot-facers, and special cutters.

Tool Steel

CARPENTER STEEL CO., 105 W. Bern St., Reading, Pa., is offering to tool steel users, in the United States only, a wall chart, 30 by 20 inches in size, known as the "Tool Steel Selector," which gives information of value in selecting the proper type of tool steel for all kinds of tools.

Drilling and Tapping Machines

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill. Bulletin 118 B, describing the features and advantages of Barnes self-oiling, all-geared drilling machines and tappers. Specifications are given for two sizes of these machines, having capacities of 1 1/2 and 2 inches.

Cutting-Oil Disinfectant

WEST DISINFECTING CO., Long Island City, N. Y. Booklet entitled "Wescol—A Practical Germicide for Use in Industrial Plants against Oil Dermatitis." The booklet describes why cutting oils should be disinfected and how proper disinfection can be accomplished.

"Bonderizing" Process

PARKER RUST-PROOF CO., 2177 E. Milwaukee Ave., Detroit, Mich. Circular illustrating and describing the Spra Bonderizing process, by means of which a rust-preventive base for paint finishes is applied to almost any type of iron or steel part.

Steel Plates and Sheets

LUKENS STEEL CO., Coatesville, Pa., is distributing a Size Card which gives the sizes of rectangular and circular sheared or flame-cut plates produced by the concern. Plates from No. 12 B.W.G. up to 25 inches in thickness are listed.

Power Presses

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 63-B, illustrating and describing the Niagara Series No. 50 single-crank power presses for producing heavy stampings requiring a concentrated pressure.

Cold-Drawn Steel

UNION DRAWN STEEL CO., 232 Harsh St., Massillon, Ohio. Bulletin entitled "Shorten that Distance between the Steel and the Finished Part," describing how production costs can be reduced by the use of cold-drawn steels.

Carbon Resistors

OHIO CARBON CO., 12508 Berea Road, Lakewood, Ohio. Folder describing the new low-resistance LV "Ohiohm" carbon resistor used for increasing the sensitivity range in certain types of industrial electronic control apparatus.

Motors, Generators, and Fans

DIEHL MFG. CO., Elizabethport, N. J. Catalogue 35 and price list, containing condensed information, arranged in convenient form for ready reference, on the Diehl line of electric motors, generators, and ventilating equipment.

Threading Machines

LANDIS MACHINE CO., INC., Waynesboro, Pa. Bulletin D-84, describing the salient features of Landmaco 1 1/4- and 2-inch pipe and nipple threading machines. Complete specifications of these machines are included.

Blast-Cleaning Equipment

W. W. SLY MFG. CO., 4700 Train Ave., Cleveland, Ohio. Bulletin S-77, illustrating and briefly describing the Sly "MasterBlast" mill, which utilizes low-pressure air instead of compressed air for blast cleaning.

Chain Tongs

ARMSTRONG BROS. TOOL CO., 313 N. Francisco Ave., Chicago, Ill. Circular containing data, including price

lists, on Ideal chain tongs for pipe, fittings, and flanges, and Ideal flange link for screwing on flanges.

Standard Appliances for Anti-Friction Bearing Mountings

BEARING APPLIANCE CO., Times Bldg., Ardmore, Pa. Bulletin B, listing the sizes of standard covers and closures for various types of anti-friction bearing mountings.

Drop-Forgings

KROPP FORGE CO., 5301 W. Roosevelt Road, Chicago, Ill. Bulletin illustrating typical drop-forgings made by this company to customers' specifications, and the equipment with which they are produced.

Motors and Generators

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Leaflet 2100, on Allis-Chalmers wound rotor induction motors. Leaflet 2183, covering Allis-Chalmers Type E direct-current motors and generators.

Casters

STANDARD TRUCK CASTER CO., Manistee, Mich. Circular listing the outstanding features of the Standard Steel-Forged unbreakable casters and the Metzgar end-wood wheel for industrial applications.

Pipe Threading Machines

LANDIS MACHINE CO., INC., Waynesboro, Pa. Circular outlining the construction details of the "Little Landis" pipe threading and cutting machine, designed for maintenance and jobbing work.

Straps and Braces

ACME STEEL CO., 2842 Archer Ave., Chicago, Ill. Bulletin showing various applications of Acme Steelstrap and the Acme unit method of bracing in packing products for shipment.

Safety Signs

MINE SAFETY APPLIANCES CO., Braddock, Thomas, and Meade Sts., Pittsburgh, Pa. Circular illustrating the porcelain enamel safety signs made by this concern for industrial use.

Electric Motors

CENTURY ELECTRIC CO., 1806 Pine St., St. Louis, Mo. Circular illustrating and briefly describing the Century line of polyphase motors which range from 1/6 to 600 horsepower.

Valves

AUTOMATIC SWITCH CO., 154 Grand St., New York City. Circular covering the line of solenoid-operated valves for automatic and remote control of air, gas, steam, and liquids.

Hydraulic Lift Trucks

LYON IRON WORKS, Greene, N. Y. Bulletin describing the features of construction and methods of operating the Lyon hydraulic lift truck. Complete specifications are given.

Pneumatic Tools

INDEPENDENT PNEUMATIC TOOL CO., 600 W. Jackson Blvd., Chicago, Ill. Catalogue 50, illustrating the entire Thor line of pneumatic tools and giving complete specifications of the different types.

Transmission Equipment

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill. Folder containing data on the Link-Belt Positive self-aligning anti-friction idler for troughed conveyor belts.

Metallic Cloth

NEWARK WIRE CLOTH CO., 351 Verona Ave., Newark, N. J. Folder giving data on typical weaves and meshes of wire cloth for testing sieves, filters, etc.

Stainless Steel

REPUBLIC STEEL CORPORATION, Massillon, Ohio. Folder (Form ADV 146), explaining the many advantages of Enduro stainless steel for textile equipment.

Tachometers

GENERAL ELECTRIC CO., Schenectady, N. Y. Circular GEA-2122, illustrating and describing the new General Electric tachometer and its advantages.

Industrial Conditions Continue to Show a Marked Improvement

If the activity in the automobile industry may be taken as a criterion of general business conditions, things are certainly turning very much for the better. The April production of automobiles was the largest for that month in any year in the industry's history, except for the record year of 1929, according to figures published by the Automobile Manufacturers' Association, 366 Madison Ave., New York. The output of all American cars for that month is estimated at approximately 477,550, representing an increase of 6 per cent over the month of March and of 29 per cent over April last year. The production for the first four months of this year was close to 1,600,000 cars and trucks, an increase of 41 per cent over the same period in 1934, when the production was 1,125,000 cars and trucks.

The Kelvinator Corporation announces that for the first time in five years the operations of the company during the first half of the fiscal year—the winter season, which is usually quiet—have shown a profit compared with the losses sustained in former years.

The Westinghouse Electric & Mfg. Co. has been awarded a contract by the Bethlehem Steel Co. for approximately $1,250,000 worth of motors, control, and power equipment for new hot and cold strip mills for the Lackawanna plant at Buffalo.

The American Iron and Steel Institute reports an increase of 142 per cent in the 1934 steel rail production over 1933.

Soviet Railroad Developments

A new Soviet-built electric locomotive has recently been undergoing tests on the Transcaucasian Railway. The locomotive developed a regular speed of about 80 miles an hour, and hauled a train weighing 813 tons up a difficult grade at an average speed of 57 miles an hour.

A new type Diesel locomotive of 1200 horsepower capacity was recently completed at the Kolomna Works, near Moscow. Further, what is claimed to be one of the world's most powerful locomotives was recently completed at the Lugansk Works in the Ukraine. This engine will haul loads of from 2500 to 4000 tons. It is about 110 feet long and develops up to 4000 horsepower. It is designed for freight service with a maximum speed of 45 miles an hour.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Coulter Hydraulic Horizontal Precision Boring Machine

Hydraulic power derived from one unit is applied both for driving the spindles and operating the table of a Type C horizontal precision boring machine being placed on the market by the Automatic Machine Co., Bridgeport, Conn. An infinite number of spindle speeds are available, ranging from 200 to 2000 revolutions per minute or from 400 to 4000 revolutions per minute, and feeds from the finest to 15 inches per minute.

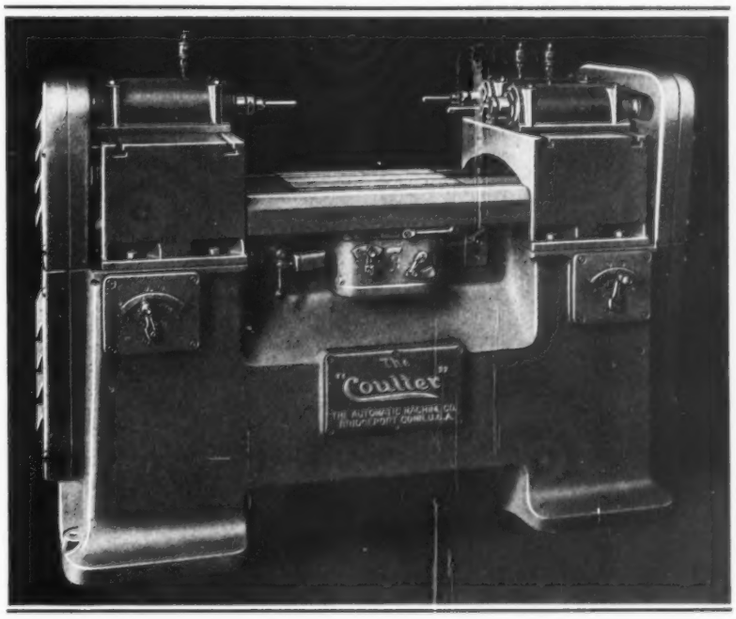
This machine is intended for the precision-boring of all kinds of material. Holes of different lengths can be bored in both ends of work with practically no loss of time, as the rapid traverse can be set to take care of any distance between the boring spindles. The rate of feed and speed for boring each end of the work can be positively set from dials mounted on the main feed panels, to take care of differences in the diameter of holes or the quality of finish desired. Thus, each end of a part can be machined independently of the other. The cycle of the machine is completely automatic and can be altered for length of stroke, rapid advance, rapid traverse, and feed stroke.

The spindle speeds are controlled by a handle on the front panels at the ends of the machine. They are obtained through a hydraulic motor on each end of the machine, which is adjustable up and down to take care of belt stretch and variation in belt length when changing from one to two spindles, or vice versa. The boring spindles can be stopped after passing through holes, so that they will not cut spirals in being withdrawn.

The standard table cycle is as follows: Rapid traverse from one side of the machine to the other, a slow feed of any required length, a rapid traverse to the opposite side of the machine, another feed for boring the second end of the work, and a return to the starting position. Other cycles providing for jumping gaps in the work or for changing the rate of feed at any point in the cycle can be obtained by simply adding to and changing the table feed controls.

The electric motor and pumps are mounted on a floating plate in the base of the machine, and are conveniently accessible. There is a coolant tank in the base which has a capacity of 5 gallons. When coolant is used, the movement of the table automatically turns it on and off at the proper points. A tank of 20 gallons capacity holds the oil for the hydraulic system. This tank is located directly over the pumps, so that they are constantly primed—a feature that eliminates air binding in the hydraulic system when the machine has been left idle for some time.

The boring spindles are mounted in special ball bearings for diamond boring. From one to three spindles can be mounted on each bridge. This precision boring machine weighs about 7000 pounds, and occupies a floor space of 68 by 30 inches.



Coulter Precision Boring Machine, in which Hydraulic Power Drives the Spindles and Operates the Table

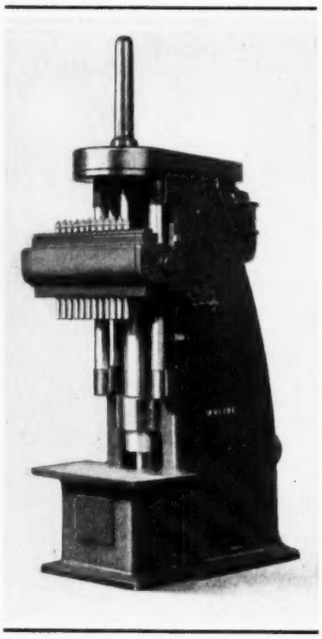
Moline Hydraulic Drilling and Boring Machine with Cylindrical Guides

Two hardened steel shafts accurately mounted on the front of the column are employed to guide the sliding rail of a hydraulic-feed drilling and boring machine recently developed by the Moline Tool Co., Moline, Ill. An advantageous feature of these cylindrical guides is that they can be ground at any time that they may wear and be provided with new hardened bushings so as to maintain the original accuracy. The bushings are made with oil and dust guards at the top and bottom, so as to keep them clean and lubricated.

In other respects, the machine follows the standard line built by the company. The continuous spiral drive is retained; but, whereas in the past, the main spiral was held to a diameter of 3 1/2 inches on all machines, it is much larger on the new machine, is made hollow, and is supported internally on ball bearings. The larger diameter spiral gives a better tooth contact between the driving and the driven gears. The main spiral is driven through spiral gears, spur gears, and V-belts by a motor mounted vertically on the back of the machine. Instead of the square fit previously furnished on the rail for the spindle units or heads, a beveled clamping surface is supplied in the new design, so that when the lower clamp is tightened, the heads are drawn squarely on the rail.

The hydraulic cylinder that actuates the sliding rail is finished both inside and outside. It is fastened to the lower side of the rail by means of a flange and is equipped with a stuffing-box and piston-rod at the lower end. The outside of the cylinder fits a bushing rigidly supported in the column at the farthest possible distance below the rail. This guide bearing, together with the two hardened shafts, makes an accurate three-cornered support that can be easily restored at any time to its original alignment.

The hydraulic pump is driven by a separate motor. Its valves and the oil reservoir are enclosed in the column. The machine shown is equipped for driving twelve 1-inch drills in cast iron. It weighs approximately 12,000 pounds.



Drilling and Boring Machine with Shafts for Guiding the Rail

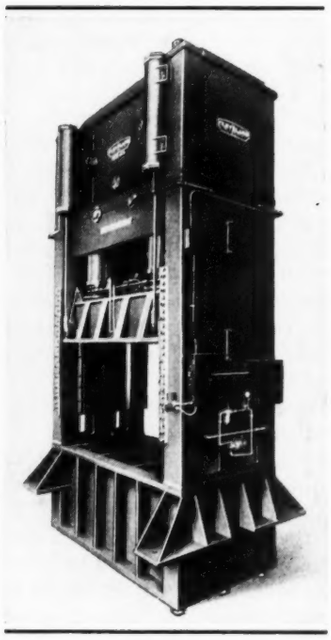
Cleveland Welded-Steel Forming Press

A power press that has a pressure of 500 tons at the beginning of the draw has recently been constructed of welded steel plate by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. This press weighs approximately 225,000 pounds and is 30 feet high. The ram measures 6 feet 8 inches by 9 feet 8 inches. It has a stroke of 24 inches and an adjustment of 32 inches. The maximum die height is 56 inches.

This press is of the four-point suspension type. No tilting of the slide can occur—a feature that is especially desirable when there is an uneven pressure on the dies. The slide is equipped with four heavy adjusting screws of the barrel type, connected by an interlocking gear system which coordinates their functioning. This power adjusting mechanism is operated through one of three push-button controls. Adjustments cannot be made while the locking motor is set, and on the other hand, the press cannot be operated until this motor is set. The two other push-button controls are used for operating the press and for adjusting the ram.

This machine has a speed of eight strokes a minute and is driven by a 30-horsepower high-torque motor. Multiple V-belts drive the flywheel, which is equipped with a multiple-disk air clutch and brake. The drive pinion engages two intermediate gears which, in turn, actuate four main shafts. This arrangement insures a balanced drive to all four points of the slide.

The housings are constructed of standard rolled shapes and flat plates, electrically welded together. Three heavy tie-rods are shrunk into place in each housing.



Cleveland Welded-steel Press of 500 Tons Capacity

Machine Designed for Using up Stub Grinding Wheels

Grinding Machine for Using up Stub Wheels

A machine designed specifically for using up grinding wheels after they have been worn down on other grinding machines to stubs about 7 inches in diameter has been brought out by the Ransom Grinding Machine Co., Oshkosh, Wis. This machine is equipped with a three-horsepower motor for operation on three-phase 60-cycle current of either 220 or 440 volts. The motor runs at 3600 revolutions per minute.

The wheel-arbor runs in four ball bearings which are lubricated by filtered oil. The arbor is 1 1/2 inches in diameter or smaller where the wheels fit on, and the distance between the wheels is 42 inches. The machine is shown in the illustration without rests, but adjustable rests can be supplied if desired. The guards are fitted with hinged doors and exhaust pipe openings. They are adjustable to suit wheel wear. The machine is regularly furnished with a push-button starter. It weighs approximately 650 pounds.

Fellows Planetary Type Gear-Lapping Machine

A machine designed particularly for lapping small gears of fine pitch has been developed by the Fellows Gear Shaper Co., 78 River St., Springfield, Vt. On this machine, the lap is of the internal gear type, as may be seen in Fig. 2, and is held stationary. Attached to the main spindle of the machine is a special self-contained planetary type of head which carries three supplementary spindles fitted with arbors for holding the work. The planetary head is rotated by the main spindle, and as it revolves it carries the three work-holding spindles with it.

Each spindle has a pinion attached to it, and these pinions mesh with individual internal gears, so arranged as to offer resistance to the free rotation of the work. In this way, pressure is exerted for the lapping operation. The planetary head is reciprocated, in addition to being rotated. The reciprocating action accomplishes the lapping, whereas the rotation distributes the lapping compound.

This lapping machine can be supplied with several different arrangements to suit the character of the work. The machine illustrated is equipped for lapping gears having thirty teeth of 0.75 module. The face width is 0.235 inch. The three work-arbors each carry six gears at a time for lapping. These gears are heat-treated before cutting, and are brought directly from the gear shaper to the lapping machine without being removed from the arbors. The lapping time does not exceed 1/2 minute for the eighteen gears.

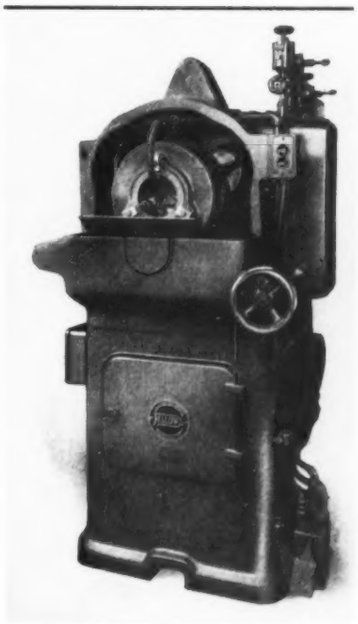


Fig. 1. Fellows Planetary Type of Machine for Lapping Small, Fine-pitch Gears

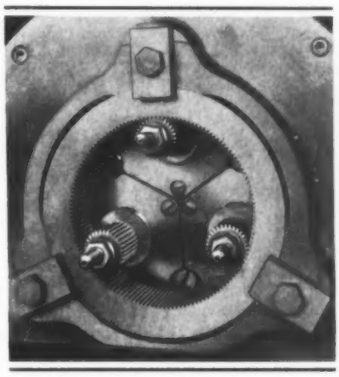


Fig. 2. Eighteen Gears being Lapped with One Internal Lap

An air ejector has been provided for the work-arbors, so as to facilitate the operation of the machine. The air cylinder is attached to the rear end of the main spindle and is operated by means of the foot-pedal seen in Fig. 1. Gears of different diameters are lapped by using internal-gear laps made to suit the diameter of the gears and the center distance of the three work-spindles. The machine can be used for lapping both spur and helical external gears.

Lay-Out Fluid for Toolmakers and Diemakers

A blue lay-out fluid intended for spreading over the surfaces of tools, dies, jigs, fixtures, etc., on which lines are to be scribed while they are being made is being placed on the market by the Dayton Rogers Mfg. Co., 1845 E. Franklin Ave., Minneapolis, Minn. This fluid dries instantly and eliminates the necessity of applying the copper-sulphate method on such work. Lines

scribed through the dark-blue surface provided by the fluid stand out in prominent contrast. The fluid is obtainable in one- and four-ounce bottles, and in one-quart cans.

Carlton Radial Drilling Machine with Motor on Spindle Head

A reversible motor mounted directly on the transmission at the rear of the spindle head is the important feature of a small light-duty drilling machine being added to the line of radial drilling machines built by the Carlton Machine Tool Co., Cincinnati, Ohio. This machine has a 9-inch column and can be supplied with 3- or 4-foot arms. The power delivered by the head motor is applied under the arm on the largest diameter of the spindle, close to the work.

Nine speed changes are available, covering a range of from 75 to 1500 revolutions per minute, from 100 to 2000 revolutions per minute, or from 150 to 3000 revolutions per minute. Four feed changes from 0.006 to 0.020 inch per spindle revolution are provided.

The mechanism for raising and lowering the arm is driven by a small reversible motor located on the arm adjacent to the column. The single lever that controls this motor for raising and lowering the arm also locks the arm to the column. In designing this machine, the aim has been to make it as fool-proof as possible. Automatic stops control the maximum travel of the arm both up and down. In addition, there is a clutch on a stationary screw which acts as a safety device for stopping the travel of the arm in case it meets an obstruction. Automatic stops are also supplied to control the maximum travel of the spindle up and down, and there is a dial that can be set to stop the feed automatically at any predetermined depth.

The machine needs to be oiled only once in six months, force-feed lubrication being provided throughout the head. From Fig. 2 it will be seen that horizontal shafts have been entirely eliminated. In details other than those described, the machine is practically identical with other low-hung radial drilling machines built by the concern.

Cincinnati Motor-Driven Universal Milling Attachment

Cincinnati Milling Machine and Cincinnati Grinders Inc., Cincinnati, Ohio, has brought out a motor-driven universal milling attachment which is built as a self-contained unit into the over-arm of milling machines, as shown in Figs. 1 and 2. An over-arm equipped with this attachment is substituted for the standard over-arm supplied with milling machines. The attachment does not interfere with the normal use of the

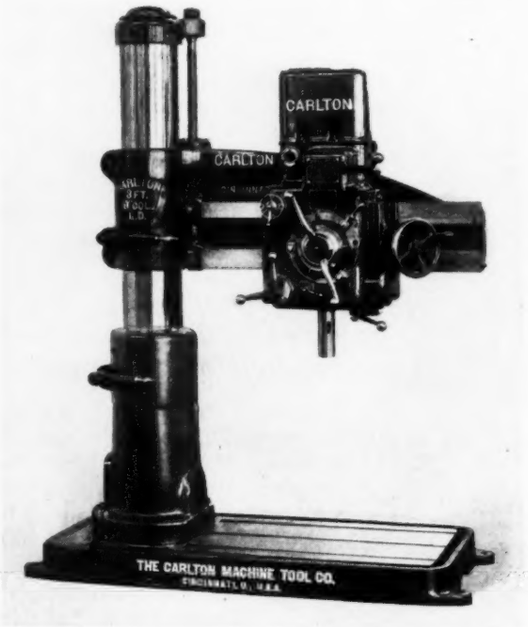


Fig. 1. Carlton Light-duty Radial Drilling Machine of Recent Design

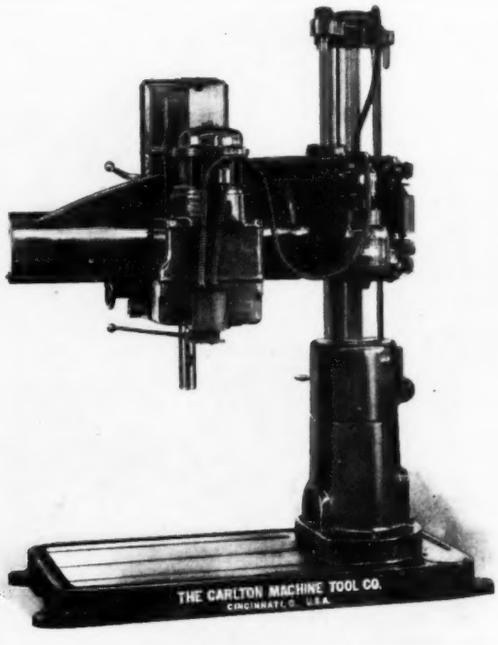


Fig. 2. Reversible Motors Drive the Spindle, and Raise, Lower, and Lock the Arm

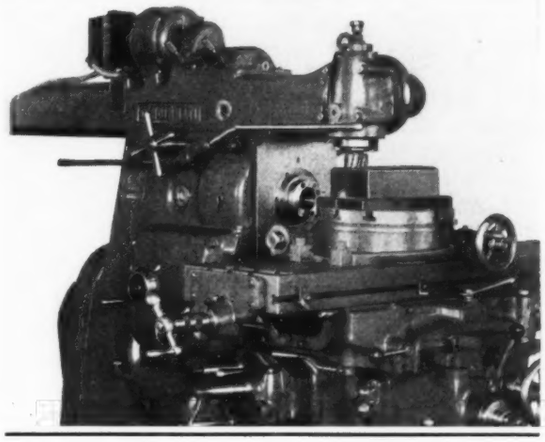


Fig. 1. Self-contained Universal Milling Attachment Applied to a Cincinnati Miller

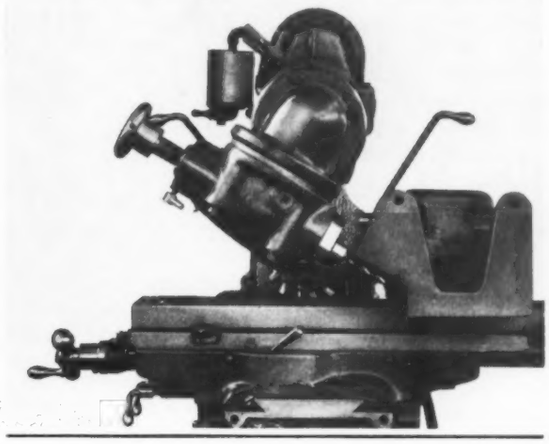


Fig. 2. Universal Milling Attachment Fitted with Hand-feeding Device

over-arm and arbor supports, as the spindle carrier can be easily swiveled out of the way.

This universal milling attachment is driven by a constant-speed one-horsepower motor mounted on top of the over-arm, which is connected to the speed-box of the attachment by means of a flexible coupling. Nine changes of speed ranging from 100 to 1030 revolutions per minute are obtainable through sliding gears. Speed changes are easily made from the left-hand side of the column by means of two levers. Automatic lubrication and a visual oil gage insure long life for the parts in the speed-change unit.

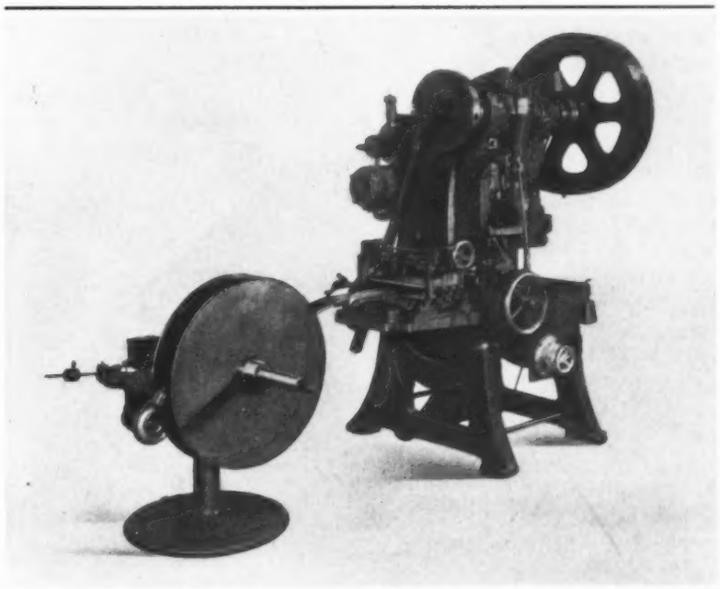
Cutters are interchangeable between the attachment spindle nose and the spindle of modern Cincinnati milling machines. The attachment spindle and the shafts in the swiveling units are supported in anti-friction bearings. One direction of spindle rotation is standard, but a switch can be supplied for reversing the rotation of the motor and the spindle.

One important advantage of this attachment is that work can be accurately milled on various surfaces with few set-ups. For example, a shaft on which a slot and a flat surface must be milled at right angles to each other, square within plus or minus 0.001 inch, can be quickly milled in one setting without removing the shaft from the fixture. Dies, jigs, fixtures, metal patterns, etc., can be machined quickly, because cuts can be combined.

The flexibility of the attachment can be increased by adding an auxiliary hand-feed quill, as shown in Fig. 2. This device is convenient for drilling and boring holes at an angle to a depth not exceeding 3 inches. A draw-in bolt seats taper-shank tools firmly in the B & S No. 7 taper hole of the sleeve.

Littell Roll Feed for Power Presses

Stock up to 16 inches wide can be fed in amounts up to 36 inches per stroke of the power press here illustrated, which is equipped with a roll feed recently developed by the F. J. Littell Machine Co., 4127 Ravenswood Ave., Chicago, Ill. This press



Power Press Equipped with New Littell Roll Feed and Power-driven Reel

can be operated at speeds up to ninety-two strokes a minute. The stock is fed directly from a power-driven reel. This reel unwinds a loop of stock and the roll feed pulls the stock from this loop rather than directly from the coil.

An important feature of the roll feed is an automatic release, which allows the operator to place the stock in the die just at the point where it is to be blanked. The first half of the roll feed is then omitted, so that the die blanks at exactly the point where the stock is placed, and thus avoids the wasting of a half blank in starting a new coil of stock through the machine.

The press is driven by a U. S. Varidrive alternating-current motor, the speed of which is controlled through a handwheel on the front of the machine that regulates a hydraulic remote control. Crankshaft speeds from 50 to 150 revolutions per minute are available to suit individual jobs.

Grob Band Saw for Internal Sawing

Internal sawing of dies and other parts can be easily done with an open-end band-sawing machine recently brought out to supplement the line of continuous-motion filing machines built by Grob Bros., S. 97th St. and W. National Ave., West Allis, Wis. This machine employs a band saw 150 feet long which, in operation, is wound and unwound from a drum in the base. The band saw passes over three guide sheaves, down through the work and table to the drum. The saw can be fed downward at cutting speeds of 50, 75, 100, and 150 feet a minute and reversed at a speed of 500 feet a minute.

To saw out a die, it is only necessary to release the tension on the saw band by a single lever movement, remove the front end of the band from the self-opening eccentric clamp which fastens it to the drum, pass it through the opening in the die, reconnect it to the drum, and again apply tension to the band. This requires about half a minute.

Three minutes of sawing can then be done at the slowest cutting speed until the end of the band has been reached, at which point the machine will stop or reverse automatically. Only eighteen seconds is required to return the band to the drum for the next three minutes of sawing. The drum is mounted on a threaded spindle, so that, in revolving, it screws itself backward and forward to wind and unwind the band. The drum is tapered to compensate for the band saw being heavier on the front or tooth side. A small wheel covered with rubberized fabric holds the band saw tight against the drum when the tension on the band is released.

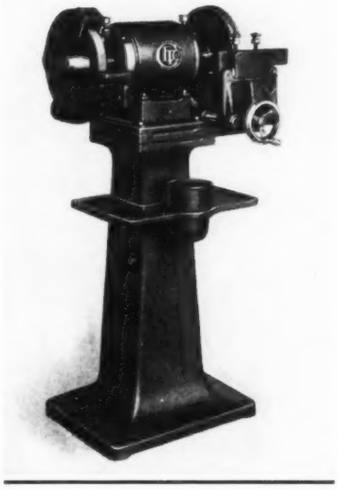
All revolving members are made of aluminum, the light weight making possible the high reverse speed and quick stopping. A variable-speed motor provides the forward speeds, and a single-speed motor the reverse motion of the saw. Band saws 0.025 inch thick by 1/8, 3/16, or 1/4 inch wide can be used. The table can be tilted in two directions in such a way that the height of the table center does not change.

Grob Sawing Machine with Band Saw 150 Feet Long

Combination Abrasive Cut-Off Machine and Grinder

Floor and bench type machines equipped with a 10- by 1/16-inch abrasive cut-off wheel on the right-hand side and an 8- by 1-inch grinding wheel on the left-hand side have been added to the line of the Cincinnati Electrical Tool Co., Cincinnati, Ohio. The machines are especially suitable for tool-room cutting and grinding, and also for the cutting and grinding of specimens in research laboratories for use in photomicrography.

The abrasive cut-off wheel runs at a peripheral speed of about 9000 surface feet a minute. The material to be cut is fed to the wheel by means of a hand-screw, the stock being held firmly on both sides of the cut, so as to prevent wheel breakage. A wheel guard of fully enclosing type affords protection to the operator. The vise or holding fixture can be tilted for cutting at any angle up to 15 degrees. Stock 1 inch in size can be cut in approximately fifteen seconds, and smaller sizes in proportion.



Machine Designed for Abrasive Cutting-off and Grinding

A safety wheel guard is also provided for the grinding wheel. The guard is adjustable to suit wheel wear and is equipped with an exhaust connection. An adjustable tool-rest is provided on the guard. The machine is driven by a motor of one horsepower rating.

Stock Reel with Needle Bearings and Automatic Brake

Coils of stock weighing up to 100 pounds can be handled by a No. 0 reel just placed on the market by the F. J. Littell Machine Co., 4127 Ravenswood Ave., Chicago, Ill. This reel is mounted on needle bearings to insure easy running. An automatic brake prevents the stock from unwinding too rapidly.

When the stock is pulled forward, a roller is raised to release the automatic brake, so that the stock can be pulled from the coil without any resistance being offered by the reel. However, as soon as sufficient stock has been unwound, a spring pulls the roller down and throws on the brake.

When fitted with arms, the reel will handle coils 9 inches inside diameter, 32 inches outside diameter, and 3 1/2 inches wide.

Littell Stock Reel with an Automatic Brake

When plates are provided, the reel will handle coils as small as 1 3/4 inches inside diameter.

Sheffield Visual Gages

Several new gages designed to show by means of illuminated scales whether or not parts made by quantity-production methods are within the specified tolerances are being placed on the market by the Sheffield Gage Corporation, Dayton, Ohio. The gage shown in Fig. 1 is intended for the rapid inspection of work and also for use as a precision comparator in the periodic checking of fine-work shop gages. A relative movement of only 0.000025 inch between the anvils causes the indicator of the dial to move 1/8 inch, while an anvil movement of 0.0001 inch causes the indicator to move 1/2 inch.

This 5000-to-1 magnification is obtained mechanically and optically without the use of such movable elements as gears, levers, or knife-edges. Instead, use is made of a patented mechanism which consists of four flat reeds, so arranged that when a part is inserted between the anvils one set of reeds is placed in compression and the other in tension. The movement resulting from the equalization of the stresses causes the pointer to move across the reading scale. The manufacturer points out that since no parts are subject to sliding friction, there is no opportunity for the gage to lose its adjustment or become inaccurate due to wear.

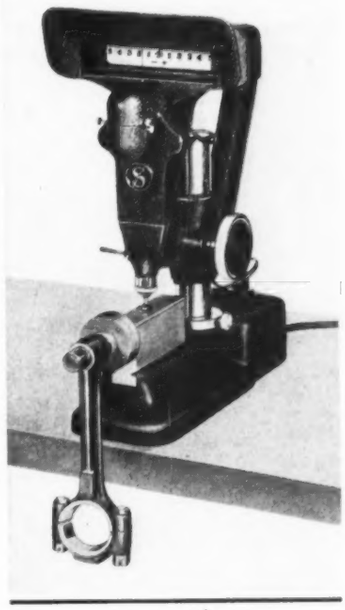


Fig. 1. Sheffield Visual Gage with 5000 to 1 Magnification

Fig. 2. Another Visual Gage with 1000 to 1 Magnification

The upper gaging element is tipped with a diamond, so as to minimize wear. The lower anvil is furnished in two interchangeable types, a flat anvil being supplied for gaging flat surfaces and outside cylindrical surfaces and a mandrel being provided for gaging internal surfaces. Holes are measured with a three-point contact. The lower anvil can be provided with inserts of tungsten carbide for wear resistance.

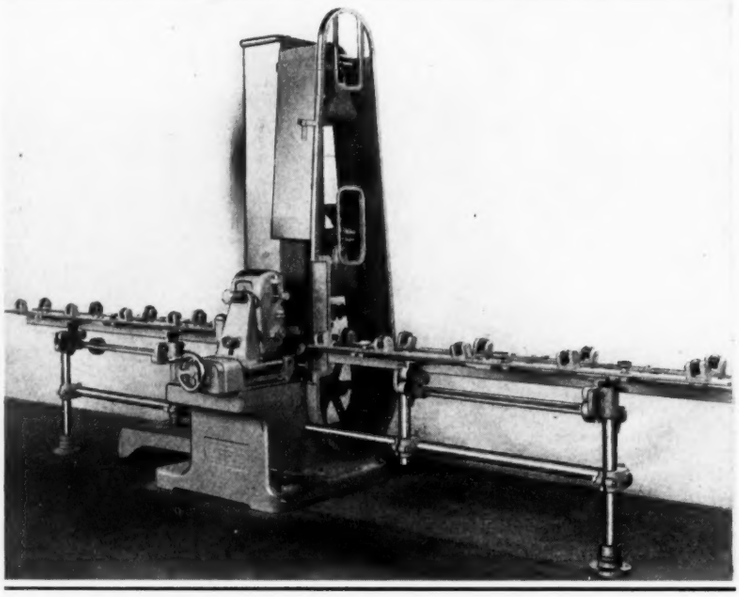
The gage head which carries the reed mechanism is readily movable up and down on a large-diameter standard, the maximum travel being 6 inches. The gage is set by applying master measuring elements between the lower anvil and the gaging element. A transformer in the base steps down 110-volt alternating current for illuminating the dial.

Fig. 2 shows a second gage which differs from the one shown in Fig. 1 in that it has a magnification of 1000 to 1.

Improved Fixture for Rod and Tube Polishing

The Type A centerless-feed polishing machines built by the Production Machine Co., Greenfield, Mass., can now be equipped with an adjustable fixture, as illustrated, for handling rods and tubes. Pieces from 1/2 inch to 6 inches in diameter and of any length can be accommodated by this fixture.

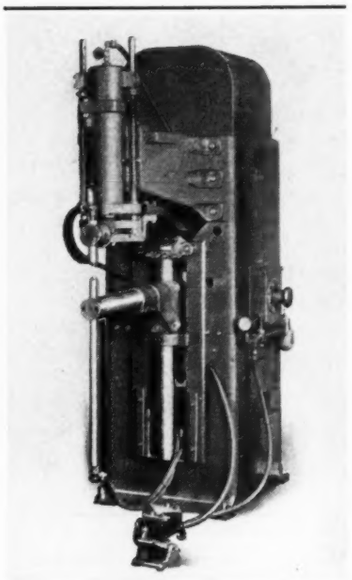
The fixture is raised vertically and held in the desired position by means of pawls. The horizontal or opening adjustment is made by turning a small handwheel to revolve a pinion which engages a rack. The guide rolls are made of hard fiber, and are positioned at an angle, so as to provide a feeding action for the work in conjunction with the centerless-feed mechanism of the machine itself.



Rod and Tube Polishing Machine Equipped with Adjustable Fixture

Thomson-Gibb Spot-Welder for Aluminum

Aluminum in a wide variety of gages can be welded on a production basis by means of several types of spot-welding machines developed by the Thomson-Gibb Electric Welding Co., Lynn, Mass. One of these machines is shown in the accompanying illustration. It is designed to provide complete control of the three welding variables — heat, pressure, and time. The pressure is carefully applied and controlled,



Spot-Welder Built Especially for Welding Aluminum

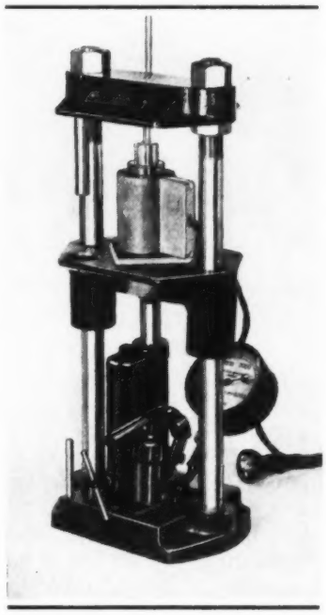
and in addition, the machine is equipped with a gage that shows the pressure between the electrodes at all times.

While this machine is designed primarily for welding aluminum and other non-ferrous metals, it is also applicable as a standard machine for a wide variety of work.

Hydraulic Press for Mounting Metallurgical Specimens

A method of mounting metallurgical specimens in Bakelite to facilitate their examination under the microscope was described in May MACHINERY, page 560. In that description, it was mentioned that the Wilkens-Anderson Co., 111 N. Canal St., Chicago, Ill., builds a small hydraulic press especially designed for doing this mounting. The press referred to is shown in the accompanying illustration.

This machine is equipped with sliding platens 5 1/2 inches wide by 8 inches long. The platens are fitted with insulating plates, bored to permit a thermometer to pass through. The platens can be opened to 8 inches. An ejector



Hydraulic Press for Mounting Specimens in Bakelite

Simplex Carbide-tool Grinding and Lapping Machine

that is positive in action is provided, as well as a 5000-pound hydraulic gage, a 1-inch mold, and a heater that operates on a 110-volt current. The machine has a height of 20 inches and weighs 55 pounds.

Simplex Carbide-Tool Grinding and Lapping Machine

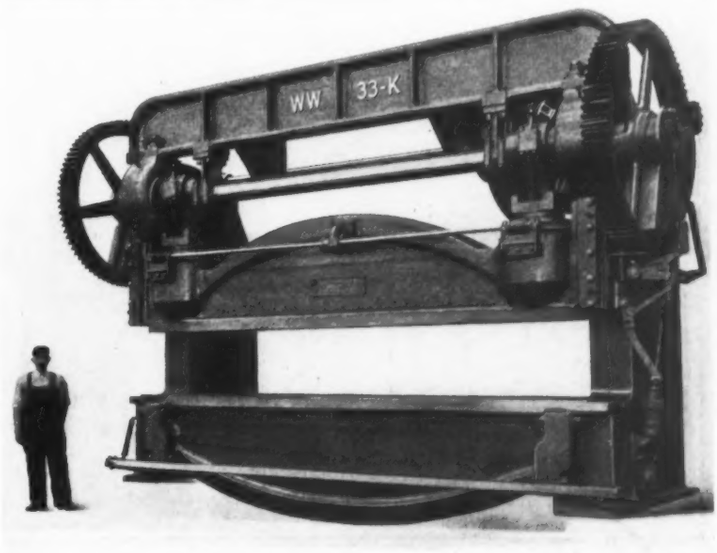
Carbide tools of various kinds can be ground and lapped on a machine of simple design which is being introduced to the trade by the Stokerunit Corporation, 5325 W. Rogers St., Milwaukee, Wis. This machine is equipped with two well supported tables for holding the tools to be ground. Means are provided for shifting each table in relation to the face of the wheel or disk and for obtaining accurate angular settings. A protractor that is interchangeable between the two tables makes possible the grinding and lapping of tools with the same setting. The lapping disk is 6 inches in diameter. It is made of high-grade cast iron and then charged with diamond dust and oil. The grinding wheel is 6 inches in diameter by 1 1/2 inches wide.

This machine can be provided with a pump, oil pan, and supply tank, and with the wheels hooded to prevent the coolant from splashing. When a pump is supplied, it is driven by a separate motor, so that it can be disconnected when coolant is not required. Equipped for supplying coolant, the machine is particularly adapted to the use of diamond wheels. The machine proper is driven by a motor of 1/2 horsepower rating. The complete weight of the equipment is 345 pounds.

Combined Press Brake, Plate Shear, and Multiple Punch

A 250-ton machine that can be employed for straight-line or group punching or that can be used as a press brake or plate shear, was recently built by Williams, White & Co., Moline, Ill. This machine has a ram 15 feet 4 inches long. The length of stroke is 5 inches, and the die spacing with the stroke down and the adjustment up, 22 inches. This machine weighs approximately 92,000 pounds. It operates at a speed of 25 strokes a minute.

With the slide elevated to its highest position, the machine will perform the same operations as the conventional type of press brake. With the slide in its lowest position, the machine will accommodate punching and shear-



Combined Press Brake, Plate Shear, and Multiple Punch

ing dies of regular design without the use of filler bolsters.

The barrel type of adjustment provided on this press, was developed by the concern as a practical method of obtaining a long adjustment in a heavy-duty machine. The construction is such that the adjusting screws are not subjected to any other strains than compression. The ram adjustment is of the self-locking type and is motor-driven.

The machine is equipped with a multiple-grip friction clutch which is engaged by an air-operated foot-treadle. An automatic stop is provided at the top of the ram stroke. The hand engagement provided for the clutch is of convenience in setting dies or in lowering the ram slowly to the work.

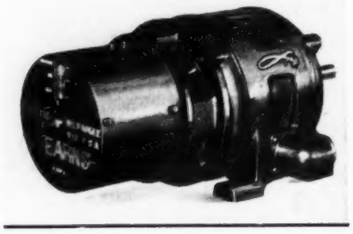
Timken Mounting for Sheave Bearings

Double-cup bearings are used in a new type of mounting developed by the Timken Roller Bearing Co., Canton, Ohio, for use in crane and hoist sheaves. This bearing mounting was designed to simplify the machining problems arising from the increased use of manganese steel in crane and hoist sheaves, and to insure an accurate mounting with its attendant long life and ease of operation.

This new mounting permits sheave hubs to be bored straight through at a single setting. In the design at the left in the illustration, the bearing cup is pressed into the hub and located by means of end caps. Shim adjustment is provided for. The central diagram shows the bearing cup located by means of snap rings. In the right-hand design, the location of the cup depends upon its press fit in the hub. These designs can be modified to combine the desired mounting with the type of side-frame construction used for the sheave.

Stearns Magnetic Disk Brakes

High-duty magnetic disk brakes, designated as Style DS, which can be supplied for floor or motor mounting, are being placed on the market by the Magnetic Mfg. Co., Milwaukee, Wis. These units are now available in five sizes, ranging from 10 to 90 foot-pounds in torque capacity. They are intended for application to machine tools, processing machinery, and any other equipment on which mechanically actuated brakes can be used. These disk brakes can also be substituted for magnetic shoe brakes.

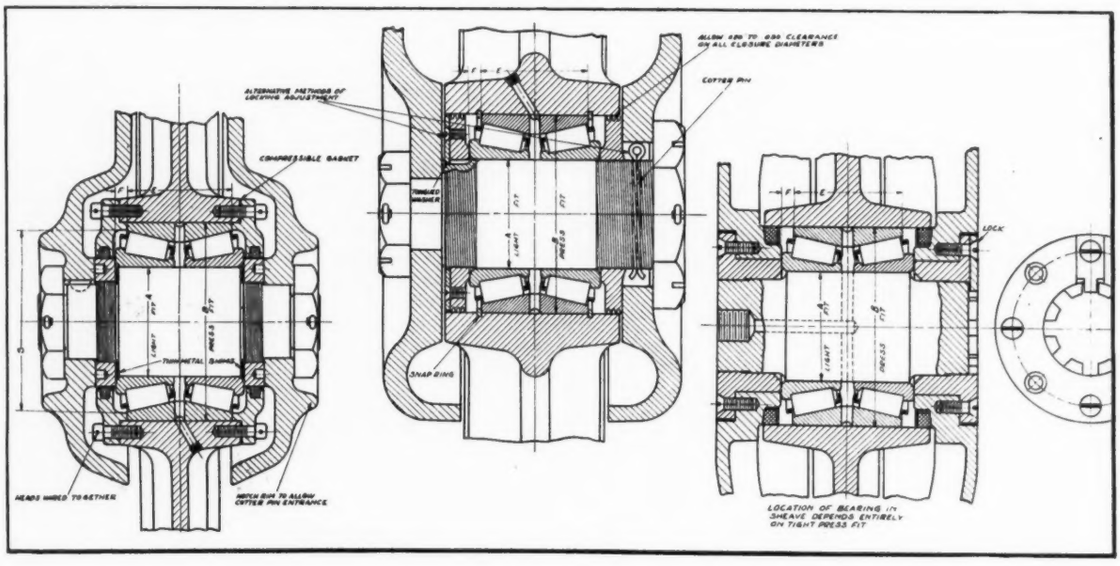


Magnetic Disk Brake Made for Floor or Motor Mounting

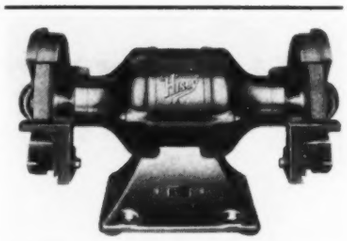
Among the important features of these disk brakes are a manual release; a lining wear indicator; constant torque at all times; a simple adjustment for torque and for lining wear; and provision for easy replacement of linings when necessary.

Hisey 7-Inch Bench Grinder

A bench grinder of the design illustrated is now made by the Hisey-Wolf Machine Co., Cincinnati, Ohio, equipped with 7-


ALTERNATIVE METHODS OF LOCKING ADJUSTMENT
COMPRESSIBLE GASKET
THIMBLE WASHER
COTTER PIN
ALLOW .020 TO .030 CLEARANCE ON ALL CLOSURE DIAMETERS
LOCK
SNAP RING
LOCATION OF BEARING IN SHEAVE DEPENDS ENTIRELY ON TIGHT PRESS FIT

Three Basic Methods of Locating the New Timken Double-cup Tapered Roller Bearing in Crane and Hoist Sheaves



Bench Grinder Added to the Hisey Line of Electric Tools

by 3/4-inch wheels and driven by a motor of 1/3-horsepower rating. The equipment is intended for light tool and miscellaneous grinding jobs. Ball bearings are provided for the wheel-spindle. The motor may be of an improved split-phase type for operation on 115- and 230-volt direct current, or of the squirrel-cage type for operation on 220- and 440-volt, three-phase alternating current.

Bantam Roller Aligner

A roller aligner designed to increase the life of anti-friction bearings used on such heavy machinery as steel and paper mills has been brought out by the Bantam Ball Bearing Co., South Bend, Ind. It is pointed out by the concern that the limiting factor in the life of roll-neck bearings and the major cause of bearing failure is poor distribution of the load when a roll neck deflects. Deflection causes a concentration of the load on a small portion of the bearing. To compensate for this condition, the size of roll-neck bearings has been increased until their capacity has become so great that a small portion of the bearing is actually capable of carrying the load.

The roller aligner brought out by the company allows the chock in which the bearing is mounted to tilt angularly, as shown in the diagram, so that the load is carried by the bearing over its entire length. This roller aligner consists of three major parts: There is a hardened steel plate which is fastened in a groove in the chock by means of a small clamp; a similar plate rests on the bottom of the housing; and between these plates there is a roller held in a cast-bronze cage. A spring mounting permits the roller to move in either direction. It is believed by the manufacturer that the roller aligner will enable smaller bearings to be used for steel-mill roll-neck service.

Ancorlox Lock-Washers

A simple locking device for nuts and bolts, consisting of a washer that is expanded against a counterbored seat in the nut and contracted against the threads of the bolt, is being introduced on the market by the Ancorlox Co., 1170 Broadway, New York City. The washers are blanked out of soft steel, brass, or other materials, with an outside diameter larger than the counterbore in the nut and an inside diameter smaller than the diameter of the bolt. They are then formed to the cross-section shown at *C*, this operation decreasing the outside diameter and increasing the inside diameter so that the washer can be slipped over the bolt and into the nut counterbore. In using one of these lock-washers, it is flattened, as shown at *A*, by employing a hollow punch or simply screwing a second nut on the bolt in back of the first. The second nut is, of course, removed after the washer has been flattened.

Since the original washer blank has a smaller inside diameter than the bolt, and a larger outside diameter than the nut counterbore, it is obvious that in flattening the washer, a high pres-

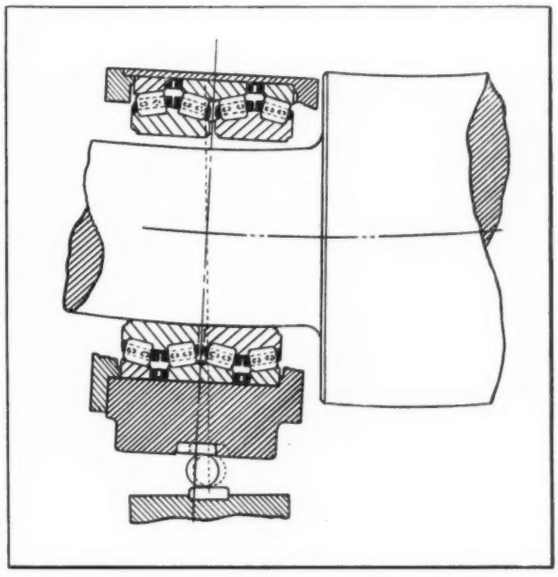
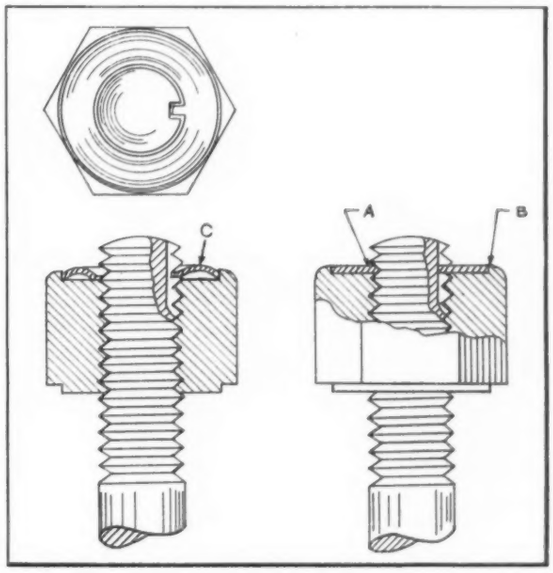


Diagram Illustrating the Function of the Bantam Roller Aligner



Diagrams Showing the Application of Ancorlox Lock-washers

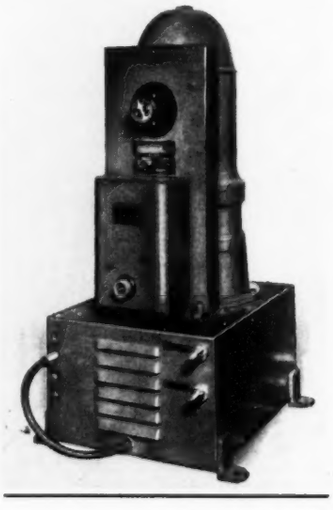
sure is produced on rim *B* of the nut and also on the threads of the bolt with which the washer is in contact. In addition to this locking action, a positive lock is obtained by means of a tongue on the washer which engages a groove in the end of the bolt.

Washers, nuts, and bolts are carried in stock in standard sizes from 1/4 to 1 inch, while larger sizes can be made special. When made of copper or bronze, the bolts, nuts, and washers form a good electrical contact, which adapts them for many applications in the electrical field.

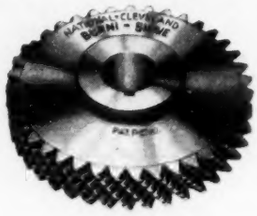
Lincoln Welder for Light Materials

A small, low-priced motor-generator type of arc-welding machine has been brought out by the Lincoln Electric Co., Cleveland, Ohio, to make available the advantages of arc welding to automobile repair, sheet-metal, and other shops that are called upon to weld materials of thin gage. This SA-100 unit opens up an entirely new field for arc welding, since it delivers current as low as 30 amperes at the arc without the use of auxiliary devices. The current range is from 30 to 125 amperes.

The generator is of a single-operator, variable-voltage type, with a 100-ampere rating. Easy welding is insured by a patented dual control which provides independent adjustment of open-circuit voltage and welding current. A Linc-Weld five-horsepower squirrel-cage induction motor designed for across-the-line starting is provided. The new welder is normally supplied for 220- or 440-volt current, but it can be furnished for 110- or 550-volt, three- or two-phase current of 60 and 50 cycles.



Lincoln Arc Welder for Light-gage Metal

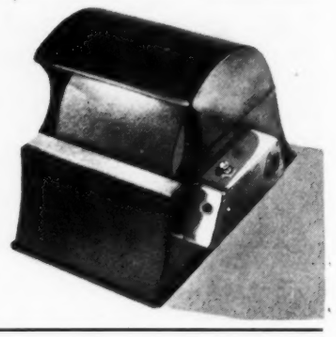


One of a Group of Three Burni-Shave Gear Finishers

Burni-Shave Gear Finishers

Circular gear-finishing tools that burnish and shave the teeth of gears in one operation are being introduced to the trade by the National Tool Co., Madison Ave. and W. 112th St., Cleveland, Ohio, primarily for use on automobile, truck, tractor, and industrial transmission gears. These tools, which themselves resemble gears, are known by the trade name of "Burni-Shave," and can be used on any gear-tooth burnishing machine or on milling machines equipped with a special fixture.

These finishing tools are applicable to spur and helical gears, both internal and external. They are used in groups of three. It is mentioned that, in some cases, gears with teeth mis-spaced to the extent of 0.002 inch and with errors in tooth form of more than 0.002 inch have been corrected within a tolerance of 0.0002 inch. Gears of average size are finished in less than fifteen seconds.



Portable Surfacer Designed with Utility and Appearance in View

Trimson Portable Surfacer and Polisher

A portable surfacing and polishing machine of unusual appearance and design has recently been placed on the market by the Trimson Mfg. Co., Cleveland, Ohio. This machine, as will be apparent from the illustration, reflects the influence of modern styling and is available in a wide choice of colors for the housing. One of the important design features is that a light concealed by the cover casts its illumination directly on the work without glare. The lip of the cover forms a handle for carrying the machine from job to job.

This machine is made with a revolving drum that is driven by a motor within the drum itself. The motor is dustproof, dynamically balanced, and is provided with sealed ball bearings. It is suspended in a rigid metal chassis that is cushioned in rubber and encased in a safety steel housing. The motor is available in two sizes—3/4 and 1 horsepower.

The drum has a cushioned surface to which paper or cloth abrasive sheets are applied. Sheets can be changed within a few seconds. The drum is 6 inches wide by 7 inches in diameter and runs at a surface speed of about one mile a minute.

This equipment is intended for use in finishing different metals, wood, synthetic plastics, fiber, hard rubber, and other materials. It can be used for removing burrs, cleaning and finishing

castings, sanding patterns, chamfering carbon brushes, and sharpening tools. The machine weighs 50 pounds, is 14 1/2 inches long, 10 inches wide, and 10 1/2 inches high.

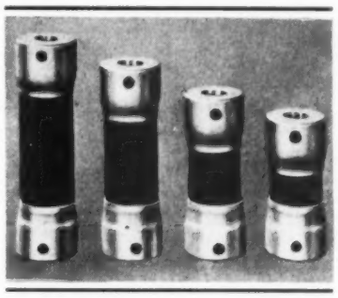
"Hand-ee" Pencil Type Grinder

A normal working speed of 18,000 revolutions per minute and an idle speed of 25,000 revolutions per minute are provided by a "Deluxe" model grinder, recently added to the line of portable electric grinders made by the Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago, Ill. This grinder, which is held in the hand like a pencil, has sufficient power for driving a wheel 1 1/4 inches in diameter. The grinder is 1 5/8 inches in diameter by 6 inches long and weighs only 15 ounces. The motor is of the universal type for operation on alternating or direct current of 110 to 120 volts.

The feature of this tool next in importance to its small size is its unusually attractive appearance, the aim of the manufacturer having been to make the tool look so well that workmen would treat it with the same care as a micrometer. The motor housing is made of "aluminated" duralumin, and the end caps of Bakelite. A fan insures cool operating conditions over long periods of time. High-speed ball bearings are provided, which are grease-sealed with sufficient lubricant to last the life of the bearings.

Light grinding, drilling, polishing, sanding, sawing, and engraving can be done with this tool. The chuck is a spring collet type that insures accurate running of all accessories. A novel sanding drum can be supplied for smoothing patterns and other parts made of wood.

Small High-speed Grinder Added to the "Hand-ee" Line of Portable Tools



Flexible Couplings for Fractional-horsepower Motor Drives

Flexible Couplings for Small Motors

A coupling designed to eliminate the transmission of torque vibration from fractional-horsepower motors to driver shafts has been developed by the Guardian Utilities Co., 1023 E. 46th St., Chicago, Ill. This coupling is made of flexible rubber treated to resist the action of oils. It is available in several lengths, from 2 1/2 inches up, to eliminate the need of shaft extensions. Four lengths of the coupling are shown in the illustration.

This coupling will operate under reasonable lateral or angular misalignment without binding, friction, or noise. It is particularly suitable for use with cushioned or spring motors, either base- or flange-mounted. The coupling enables quick alignment of a motor with the shaft to be driven. It has been successfully applied to oil burners, stokers, printing equipment, small pump units, etc. The coupling can be made with any combination of bores 5/16, 3/8, 7/16, and 1/2 inch in diameter.

Landis Die-head Designed for Cutting Tapered Threads

Revolving Die-Head with Taper Attachment

A revolving die-head equipped with an attachment for producing tapered threads has been placed on the market by the Landis Machine Co., Inc., Waynesboro, Pa. This die-head is an adaptation of the 3/4-inch Lanco head, but it has a standard capacity up to 1 1/4-inch American tapered pipe threads, with a maximum thread length of 1 1/4 inches. By using special oversize chaser holders, diameters up to 2 3/4 inches can be cut, with a maximum thread length of 1 1/8 inches. Any amount of taper can be provided up to 2 inches per foot, and the head can be applied to practically any make of automatic chucking machine that employs a revolving type of die-head.

The taper cutting action is obtained through a cam that is integral with the operating ring. Attached to the closing ring of the die-head is a cam-shoe which is machined to correspond with the cam. As the threading spindle moves forward, the closing yoke of the die-head comes in contact with the usual adjustable nut on the stop-bar of the machine just as the chasers begin to form the thread. At this point, the forward travel of the operating ring is retarded, while the die-head itself continues to move forward for cutting the thread. During this movement, the chasers open gradually and thus produce a tapered thread.

When the cam-shoe has traveled the full length of the cam on the operating ring, the die-head opens automatically.

The forming and finishing of the thread are accomplished by the first few teeth of the chasers, and consequently, the cutting strains are no greater than in cutting a straight thread of corresponding diameter. The length of a tapered thread which can be cut is not limited by the width of the chasers, but by the length of the cam travel. This free-cutting action insures a good finish on the thread and a long chaser life.

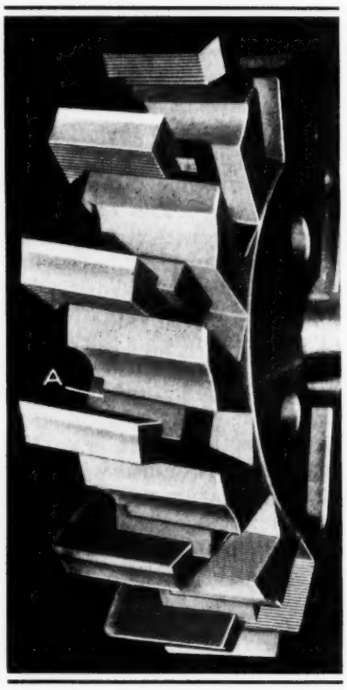
Ingersoll Zee-Lock Face Milling Cutters

Inserted-blade milling cutters in which a Z-shaped wedge retains the blades in the cutter body are being introduced on the market by the Ingersoll Milling Machine Co., Rockford, Ill. As shown at *A* in the illustration, each of these wedges hooks over the front of the cutter body and the back of the corresponding blade. Thus it is impossible for the blade to shift backward or inward away from the cut. The back hook of the wedge is on a slant, so that when the cutter blade is re-inserted and moved outward a distance of one serration, it is also moved forward to compensate for the slight amount of face wear. The main adjustment of the blades, however, is outward or radially, which is always the direction of the principal wear.

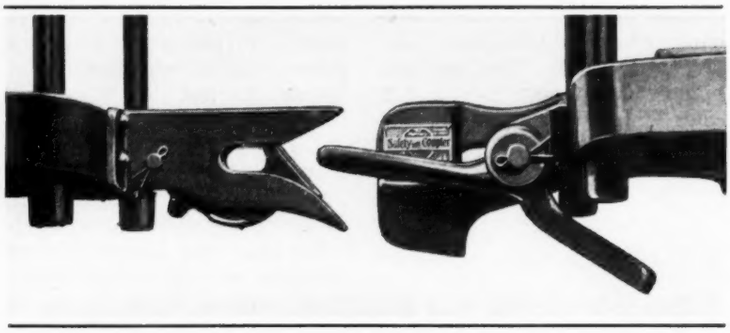
No additional parts are required for resetting the blades, because they adjust themselves automatically. The wedge is not disturbed by the thrust of the cut, as this is absorbed by the serrations.

The Zee-Lock feature is applicable to many kinds of cutting tools. Medium-duty cutters are made with blades 3/8 inch thick and with a blade spacing of about 1 inch for medium duty or finishing operations. Heavy-duty cutters are made with blades 1/2 inch thick, spaced from 1 1/2 to 1 3/4 inches. There are also extra heavy-duty cutters with blades 3/4 inch thick, spaced about 3 inches apart.

The cutter body is made with the National Standard planer or flange-nose drive or to fit any milling machine or horizontal boring mill. The blades can be made of forged high-speed steel, super-cobalt high-speed steel, J-Metal Stellite, etc., or tipped with cemented carbide. The bodies are made of forged and heat-treated chrome-molybdenum steel.



Ingersoll Milling Cutter with Zee-Lock Wedges



Safety Coupler of Self Engaging Type for Facilitating the Operation of Industrial Trailers

Mercury Self-Coupler for Industrial Trailers

Greater speed and ease of handling are advantages claimed for a self-coupler of improved design, developed by the Mercury Mfg. Co., 4119 S. Halsted St., Chicago, Ill., for use on industrial trailers. The flat-top jaw is installed flush with the trailer deck, so that its smooth top offers no obstruction when an overhanging load is carried on the trailer.

The latch dog moves downward to open, and this bottom-release action can be accomplished by the pressure of a foot on either side pad. The pads are reached easily, even if a load overhangs the end of the trailer.

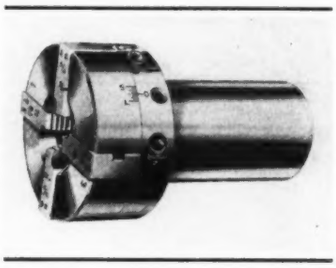
With this self-coupler there is no need for the operator to step between two trailers in order to uncouple them, and he is not tempted to use his hands. The latch spring is entirely enclosed within the jaw casting, and thus is protected from moisture and dirt. This coupler is now standard equipment on Mercury industrial trailers.

Geometric Solid Adjustable Die-Head for Cutting Short Threads

A Style DJ solid adjustable die-head designed primarily for cutting short threads when the time required for backing off is not important is the latest addition to the line of thread-cut-

ting devices manufactured by the Geometric Tool Co., New Haven, Conn. This die-head can also be used to advantage on chucking machines and similar equipment, because it will swing in almost the same space as the conventional solid die. One die-head of the new style will cut a wide range of different diameters and pitches through the use of inexpensive removable chasers.

Another feature of this die-head is that each set of chasers is adjustable for size. To cut to the desired class of fit, to obtain the specified pitch diameter, and



Geometric Solid Adjustable Die-head

to adjust the chasers for wear or resharpening, it is merely necessary to loosen one screw and tighten another. The tool is of unusually simple design, consisting only of a body for holding the chasers, a cam for controlling size adjustment, and a few screws and plates. In addition to compactness and simplicity of construction, low cost is an advantage emphasized by the manufacturer.

The die-head is built in sizes from 5/16 inch to 6 inches maximum diameter. All parts are made of alloy steel, hardened and ground.

Pressure Meter for Resistance Welders

Resistance welding operations are facilitated by means of a meter manufactured by the Thomson-Gibb

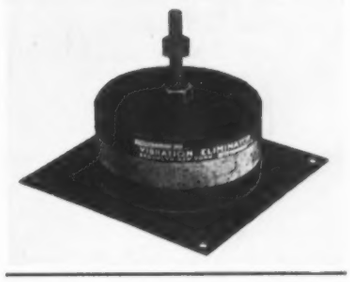
Meter that Shows the Pressure Applied in Resistance Welding

Electric Welding Co., Lynn, Mass., which shows the pressure applied at the welding points. Pressure is, of course, an essential factor in obtaining good results with resistance welding.

The pressure meter is operated by hydraulic means. It is available in several types to suit different ranges of pressure. Once a certain pressure has been determined by means of the meter to be the most desirable for a given class of work, it is an easy matter to reset the welding machine to maintain that pressure.

Vibration Eliminator

A shock absorber or cushion designed to eliminate the vibration of machinery is being introduced on the market by the Vibration Eliminator Co., 41-26 Thirty-seventh St., Long Island City, N. Y. This vibration eliminator consists chiefly of a base stamping, a supporting housing, and a disk of natural cork. It is intended that one of these devices be fastened to each leg or supporting point of a machine base and bolted to the floor. As cork is used for the vibration isolating medium, water, oil or temperature changes do not affect the efficiency of the device. The eliminator shown may be

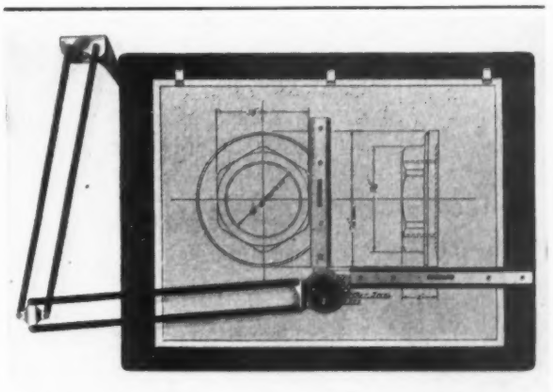


Vibration Eliminator Designed for Use under Machinery

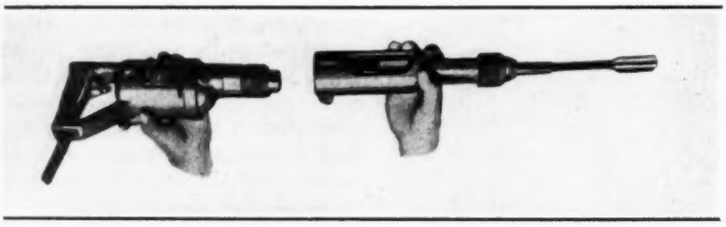
supplied for any load between 175 and 375 pounds. Six of them will support a machine weighing 2250 pounds.

Drafto Portable Drawing Machine

A larger size has been added to the line of portable drawing machines made by the Drafto Co., Cochranton, Pa. The new board, known as the No. 25-H, will accommodate sheets up to 15 by 20 inches. One of its features is that the arms are attached on the under side by a rigid dovetail mounting that permits the scales to be moved to all corners of the paper without interference. Also, three paper clamps are countersunk into the board, so as not to interfere with the free movement of the scales.



Portable Drawing Machine for Sheets up to 15 by 20 Inches



Changing the "Do-All" Combination Electric Tool from a Hammer into a Drill or Vice Versa

The protractor is graduated to 2 degrees. It can be quickly set at the required angles. The locking device produces an equal tension at all angles, thus preventing slippage that might spoil a partly finished drawing. The integral scales are made in one piece, and therefore can never get out of square with each other. They are permanently attached to the protractor and can be moved through 180 degrees. Detachable scales 6, 8, or 10 inches long can be furnished for quick mounting on the integral scales.

The steel arms of this drafting machine are given an oxidized finish, while the protractor and scales have a flat silver finish that affords a sharp contrast to the black graduations. The board proper is made of lightweight Masonite. While it is primarily designed for desk use, the board is light and rigid enough for portable use.

"Do-All" Combination Electric Tool

A portable electric tool that is primarily a hammer, but that, with a simple adjustment, can also be used as a drill, grinder, or buffer has been brought out by the Wodack Electric Tool Corporation, 4627 W. Huron St., Chicago, Ill. The hammer mechanism is constructed of only two working parts. By simply opening the chuck and loosening a cap-screw, the hammer member can be removed, as shown in the illustration, and the tool used as a drill for producing holes up to 3/8 inch in metal. The tool is also used for grinding and buffing with the hammer member removed.

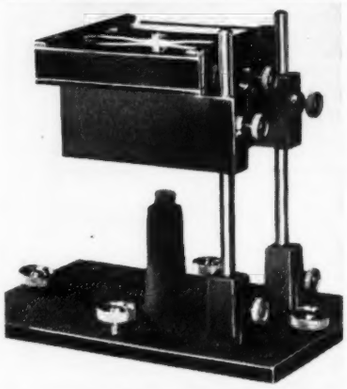
When used as a hammer with star drills, holes up to 1 3/8 inches in diameter can be cut in concrete and masonry. Special tools can be employed for chipping, chiseling, cutting, and vibrating. The tool is driven by a motor of the universal type.

Operating Air Valve which Provides Working and Idling Pressures

Ross Two-Pressure Air Valve

The actual pressure required for the idling stroke of a piston in a cylinder is much less, in most cases, than that required for the working stroke. Based upon this principle, the Ross Operating Valve Co., 6494 Epworth Blvd., Detroit, Mich., has developed a two-pressure operating air valve which provides the full-line pressure for the working stroke and a selected reduced pressure for the return or idling stroke. This two-pressure feature effects a considerable saving in air consumption.

The two-pressure operating valve is identical with the standard four-way valves made by the company, except that a built-in reducing valve is added. This reducing valve can be regulated from zero to the full-line pressure. The pressure reduction is accomplished in one supply chamber only. The valve can be set for the reduced pressure after it has been installed, and then sealed until a change in pressure is desired.



Pin-hole Instrument for Diffraction Analysis of Metals

Instrument for X-Ray Diffraction Analysis of Metals

A pin-hole instrument for the high-speed, high-voltage, diffraction analysis of metals is being placed on the market by the St. John X-Ray Service, Inc., 30-20 Thomson Ave., Long Island City, N. Y. This equipment is based on the "pin-hole" principle of using tungsten radiation at 200,000 volts or more, as in radiographing castings and the like, so that a powerful beam of X-rays passes through the metal being analyzed. Exposures of two hours or less are sufficient.

The method has been applied to brass, tin, steel, and other metals